UNION OF SOUTH AFRICA

DEPARTMENT OF COMMERCE AND INDUSTRIES

DIVISION OF FISHERIES
INVESTIGATIONAL REPORT No. 25

# THE SOUTH AFRICAN PILCHARD
*(Sardinops ocellata)*

# AND MAASBANKER
*(Trachurus trachurus)*

# VARIATIONS IN THE PHYTOPLANKTON OF THE ST. HELENA BAY AREA DURING 1954

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BY

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## I. SUMMARY.

This paper is one of a series on the life history of the South African Pilchard, *Sardinops ocellata* (Pappé) and the Maasbanker, *Trachurus trachurus* (Linné), and deals with the variations in the phytoplankton in the St. Helena Bay area.

After the introduction and discussion of the various methods used to obtain an indication of phytoplankton variations, the relationship between the occurrence, quantity and distribution of phytoplankton and certain hydrological factors is discussed. The phytoplankton genera recorded at two selected stations are tabulated in order of abundance; the quantity of phytoplankton in relation to depth distribution is also discussed. Further chapters deal with the occurrence of winds, upwelling and other physical factors affecting the occurrence of phytoplankton. The general distribution and occurrence of phytoplankton genera as reflected in the analyses of net catches is described.

Two methods of collecting data and material were used in the study of phytoplankton, viz:—

(*a*) Plankton tow-nets to ascertain the qualitative and quantitative occurrence and distribution of phytoplankton; and

(*b*) A Nansen-Petterson water-bottle to take water samples at different depths for chlorophyll extraction and phytoplankton counts. This method was used to illustrate quantitative studies of phytoplankton.

The use of plankton nets was of great value in indicating the abundance and distribution of phytoplankton larger than 50 microns provided that a large number of hauls were made during a short period. The method used for the extraction of chlorophyll from sea-water samples by means of acetone provides merely an *indication* of the productivity of the sea in the area in which the research is carried out. Additional factors such as plant matter detritus hinder colour comparisons. This method therefore only produces good results when used in conjunction with other methods, but has the advantage that it makes possible the investigation of a great number of samples within a relatively short period. It has been found that the laborious method of counting phytoplankton genera by means of a squared slide under a microscope, produces satisfactory results.

The findings of this preliminary investigation into the variation of phytoplankton are briefly as follows:—

(1) Large volumes of phytoplankton were recorded in the St. Helena Bay area during the course of the year; phytoplankton was *most abundant* during the *spring and summer seasons*, *less abundant* during the *winter season* and *scarce* during the *autumn season* of 1954.

The heaviest bloom of phytoplankton occurred mainly between the depths of 0 and 20 metres; only some of the dominant genera sometimes occurred at 30 and 50 metres. Of the great number of genera observed in the counts and net hauls, the following were dominant in the catches at some time or other: *Chaetoceros*, *Nitzschia*, *Thalassiosira*, *Skeletonema*, *Asterionella*, *Prorocentrum*, *Ceratium* and *Peridinium*. Although *Flagellata* appeared in large quantities for a short period, they were in nearly all instances dominated by the diatoms. Occasionally the concentration was sufficiently high to colour the water, for example, during March when *Prorocentrum* showed a wide distribution. During every month of the year (1954) phytoplankton occurred in some part or other of the commercial fishing area.

It would appear that *Chaetoceros*, which was most common during the year, is able to increase rapidly after upwelling has occurred, provided that other conditions are equally favourable.

(2) There was evidence of a relationship between the phytoplankton abundance and certain chemical and physical factors. Winds blowing from a south-easterly direction during the spring and summer seasons cause upwelling as a result of which colder, heavier and nutrient-richer water is found near the coast.

Under favourable conditions of abundant sunshine there is a considerable increase in phytoplankton during the spring and summer seasons. During these seasons the temperature and salinity are usually relatively low, while the phosphate content is relatively high. However, during a calm period, the surface temperature rises considerably as a result of increased solar radiation. Although there is an *indirect* relationship between winds, upwelling and the increase in total phytoplankton, there is a *direct* relationship between the decrease in inorganic phosphate and the increase in phytoplankton. There would also appear to be a relationship between the abundance of phytoplankton and temperature and salinity.

(3) The large shoals of fish which were found in the commercial fishing area of St. Helena Bay were provided with sufficient food organisms in the form of phytoplankton and zooplankton.

## 2. INTRODUCTION.

After the arrival of the research vessel, *Africana II*, in 1950, the Division of Fisheries launched an extensive programme of research into the general biology of the pilchard *Sardinops ocellata* (Pappé) and the maasbanker *Trachurus trachurus* (Linné). These fish are commercially exploited on a large scale on the West coast of the Union and off South West Africa. As these two species feed on plankton, a study of the abundance and seasonal variation of the latter necessarily constituted an important part of the general research programme. The assessment of the available sources of plankton on our West coast is not only of importance in view of the fact that it provides a basic source of food for marine organisms, but the amount and composition of the plankton are also indicative of the productivity of the area in which the research is conducted. In this connection a study of the variations in the phytoplankton concentration is of primary importance because this group, together with the nutrient salts, provides the basis of all oceanic life.

Due to a shortage of personnel during the first few years of research, the scope of the plankton research was limited to a general survey of the plankton of the area. The only method of collection was by means of plankton tow-nets. It became evident, however, that the data obtained by means of this method, expecially in respect of the study of phytoplankton were inadequate and that this method would be successful only if a large number of hauls were made over a wide area within a short period. In that case nets would be valuable as they would show:—

(*a*) the greater quantitative difference in distribution, as well as

(*b*) the qualitative distribution of genera which are larger than 50 microns.

Such a programme is only practicable if there is a large staff available to carry it out. Methods had to be considered, therefore, by which the quantitative distribution and variation of the nannoplankton as well as of species which are larger than 50 microns could be assessed by a relatively small number of people.

There are many methods of assessing quantitative variations in the phytoplankton, none of which is completely satisfactory. It was therefore decided to employ a combination of various methods in order to obtain a satisfactory indication of the abundance, distribution and variation of phytoplankton in the commercial fishing area.

In this report the term *phytoplankton* includes all diatoms and chlorophyllose *Protozoa*, such as *Peridinium*, *Ceratium* and *Dinophysis*.

## 3. RESEARCH AREA.

The data used in this report were obtained from three groups of stations, viz:—

(*a*) Stations DA 32° 13′ S, 18° 07′ E and DB 32° 31·0′ S, 17″ 55′ E.

These stations are situated in the northern and southern parts respectively of the commercial fishing area between St. Helena Bay and Lambert's Bay (Fig. 1). Observations were made at these stations once a month by R.S. *Africana II*.

(*b*) Stations L, M, O, N and Q. These stations cover a considerable area and are all situated within the commercial fishing area (Fig. 1). Once a month R.S. *Africana II* occupied these stations.

(*c*) Stations JJ, NN and PP were occupied by R.V. *Schipa* or P.B. *Palinurus* once a month.

## 4. METHODS.

Two stations, DA and DB (Fig. 1) were selected for the assessment of the phytoplankton variations in the St. Helena Bay area and the following procedure was followed once a month:—

(i) One-litre water samples were obtained with the aid of a Nansen-Pettersson water-bottle at the following depths: 0, 5, 10, 20, 30 and 50 metres. The unpreserved water sample was kept in a dark bottle in a cool place. Within 36 hours after these samples had been taken, they were filtered under reduced pressure for colour extraction. Filtration was carried out by means of a Büchner funnel provided with Whatman No. 50 filter paper on which a layer of cotton wool approximately 1 inch thick had been placed. The filter paper together with the cotton wool was placed in a beaker containing sufficient 90 per cent pure acetone to cover the filter paper and cotton wool. The samples were left standing in this solution in the dark for at least 12 hours. The acetone containing the extracted colour

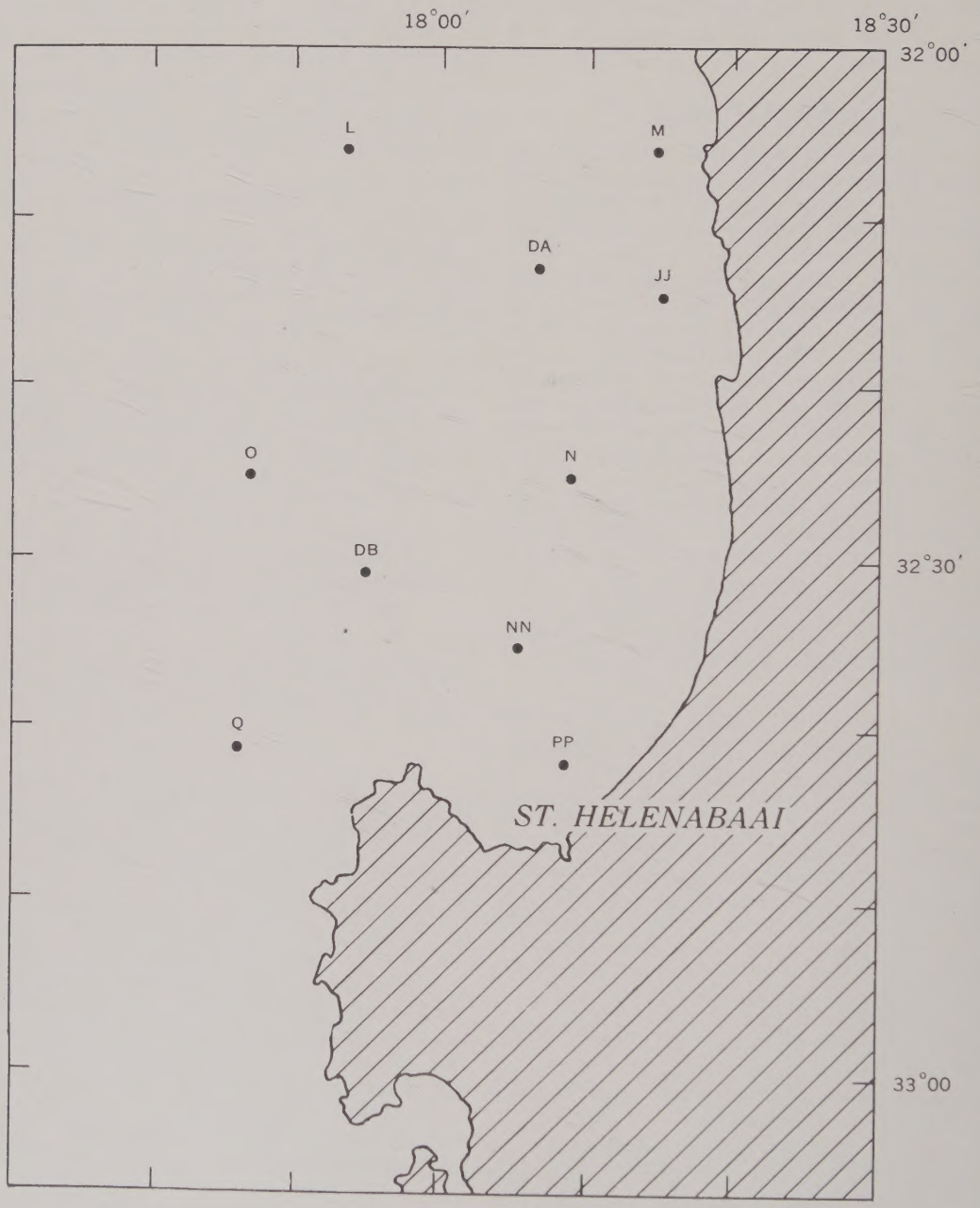


FIG. 1 RESEARCH AREA

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pigments was filtered through a coarse filter paper to remove the disintegrated particles of the original filter paper and cotton wool. Direct visual colour comparisons of the samples with Harvey standards (Harvey, 1934) were then carried out.

It was found that the cotton wool which had been placed on top of the filter paper not only reduced the time of the filtering process but also served as an effective filter. The relatively thick layer of cotton wool hampered the colour comparison, however, as a large volume of acetone is required for the complete immersion of the filter paper and cotton wool. The cotton wool which had dried on the funnel absorbed a considerable volume of acetone on being immersed. The relatively large volume of acetone consequently caused an excessive dilution of the colour pigments. It was found that if a very thin layer of cotton wool was placed on the filter paper, it still reduced the time of the filtration without requiring too large a volume of acetone. With the thin layer mentioned it was possible to cover the filter paper and cotton wool completely with 15 cc. of 90 per cent acetone. As the use of this thinner layer of cotton wool was only introduced later during the year under discussion, colour extractions made during the year 1954 are not included in this report, but this method will in future produce good results.

(ii) A water sample bottle was filled at the above-mentioned depths at the same time as the water sample for colour extraction was taken. This sample was preserved for phytoplankton counts by the addition of a few ml. of 38 per cent neutral formalin. The following procedure was adopted in respect of the counts. After the sample had been well shaken up, 25 ml. were pipetted into a tube and centrifuged at 2,500 revolutions per minute for 20 minutes. The upper 20 ml. were drawn off carefully and a count was made with the remaining 5 ml. Counts were made on a square object glass measuring 2 × 2 mm. (depth of counting-chamber, 1 mm.) under the 125 × magnification of a Leitz *Ortholux* microscope.

(iii) A N50 net haul was made at selected stations.

The nets were of the standard type used by R.R.S. *Discovery II* (Kemp, Mackintosh and Hardy, 1929).

At stations L, M, N, O, Q, DA and DB (Fig. 1) vertical hauls were made from 50 to 0 metres. At stations JJ, NN and PP, served by the smaller vessels (R.V. *Schipa* and P.B. *Palinurus*), horizontal surface hauls were made for 10 minutes with the aid of a N50 net.

Determinations of the inorganic phosphate content and of the salinity were made according to standard methods.

## 5. THE RELATIONSHIP BETWEEN THE ABUNDANCE AND DISTRIBUTION OF PHYTOPLANKTON AND CERTAIN HYDROLOGICAL FACTORS.

Samples of water for phytoplankton counts, chlorophyll extractions, temperature observations, salinity and phosphate content estimations were taken by means of a Nansen-Pettersen water bottle. Samples for phytoplankton counts and colour extractions were taken at 0, 5, 10, 20, 30 and 50 metres; samples for temperature observations, salinity and phosphate content estimations were taken at 0 and 25 metres. Vertical plankton-net hauls were made between 50 and 0 metres.

### (a) DA (Fig. 1.).

#### (i) Total Phytoplankton Counts.

The counts for the depths mentioned are discussed separately. The logarithms of the total counts (all genera) minus the logarithms of the smallest number of cells counted per litre, viz., 2,500 cells/litre, are graphically represented as phytoplankton units (Fig. 2). Counts are therefore expressed as phytoplankton units. All chlorophyll-lose organisms were taken into account for these counts.

0 *metres.*

Phytoplankton blooms were recorded at this station during the following months: January, March, June, September, October, November and December. These blooms ranged from 40,000 cells/litre during March up to as many as 1,377,000 cells/litre in September.

Not only was the heaviest bloom recorded during a month in spring, but phytoplankton was very abundant during every month of that season. During the first month of the summer season (December) no less than 1,300,000 cells/litre were recorded. As previously stated, the smallest bloom, comparatively speaking, occurred during March, while considerable phytoplankton volumes (350,000 cells/litre) were present during one month of the winter season (June).

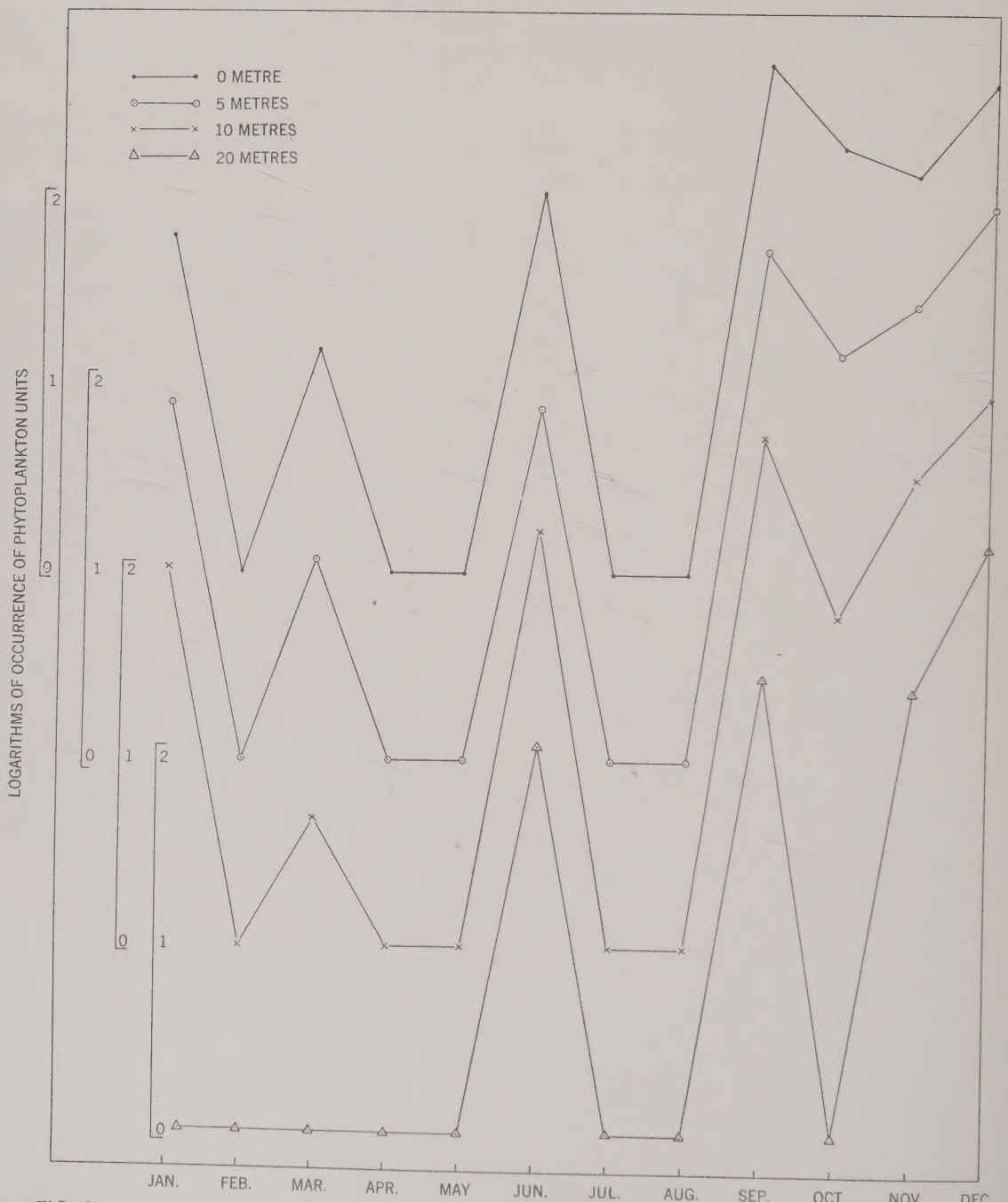


FIG. 2 OCCURRENCE OF PHYTOPLANKTON UNITS AT 0, 5, 10 AND 20 METRES, STATION DA, 1954.

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At 0 metres, therefore, the greatest concentration of total phytoplankton occurred during the spring (3 months) and summer seasons (2 months). During the winter season the phytoplankton was less abundant and during autumn the lowest level was reached.

5 *metres.*

The graph of total phytoplankton counts for this depth (Fig. 2) shows the same trends as the graph of total phytoplankton counts made at the surface. The maximum bloom was, however, recorded during early summer (December) instead of in September as in the case of surface counts. During December up to 2,285,000 cells/litre were present at 5 metres. A slightly larger number of cells/litre was also recorded at this depth than at 0 metres during September. At the surface the phytoplankton graph shows a decline from October to November; at 5 metres, however, a rise occurs.

The total counts recorded in the 5 metre sample were, therefore, generally somewhat higher than those recorded at the surface.

10 *metres.*

The phytoplankton graph for this depth is very similar to that for 5 metres. The maximum bloom was again recorded during December (2,262,500 cells/litre). As in the case of the 5 metre sample this depth (10 metres) also contained more cells/litre than at 0 metres except in March when volumes were lower.

20 *metres.*

The graph of total phytoplankton counts for this depth also shows that high phytoplankton volumes were recorded only during June, September, November and December. As in the case of the two previous depths, maximum bloom was also recorded in December. During that month 3,675,000 cells/litre were recorded, a considerably higher number than that recorded at any other depth. During a few months a number of the dominant genera were recorded at 30 and 50 metres but it is clear that the optimum conditions for the growth of phytoplankton were present in the 0 to 20 metre layer. This abundance is discussed under the depth distribution of the individual genera (page 12).

### (ii) Inorganic Phosphate Content (mg-atom P/m³).

0 *metres.*

The maximum (1·22 mg.-atom P/m³) and minimum phosphate contents (0·23 mg.-atom P/m³) were recorded in January and March respectively. During July, August and November, the phosphate content was also comparatively high (Table 1 and Fig. 3). A comparison of the graphs of the phosphate content and total phytoplankton counts recorded at this depth (0 metres) reflects a definite correlation. During the year there was a correspondence between the decrease in phosphate and the increase in total phytoplankton. Such a direct correspondence could be observed ten months out of twelve.

During June a considerable phytoplankton bloom occurred. No corresponding decline in phosphate content was observed, however, (Figs. 2 and 3) but there was a slight rise since the previous month. An analysis of the winds in the research

TABLE 1.

STATION DA.

| 1954. | 0 Metres. | | | 25 Metres. | | |
|---|---|---|---|---|---|---|
| | S‰. | T°C. | P mg–atom/m³. | S‰. | T°C. | P mg–atom/m³. |
| January | 34·74 | 13·37 | 1·22 | 34·70 | 9·11 | 1·97 |
| February | 34·76 | 14·97 | 0·77 | 34·76 | 9·81 | 1·74 |
| March | 34·76 | 16·57 | 0·23 | 34·81 | 10·17 | 1·80 |
| April | 34·79 | 13·87 | 0·78 | 34·79 | 11·02 | 1·53 |
| May | 34·87 | 14·22 | 0·71 | 34·82 | 13·71 | 1·11 |
| June | 34·78 | 13·73 | 0·77 | 34·78 | 13·66 | 0·88 |
| July | 34·65 | 12·76 | 1·77 | 34·83 | 12·26 | 1·35 |
| August | 34·81 | 13·28 | 1·08 | 34·99 | 12·48 | 1·46 |
| September | 34·81 | 13·52 | 0·70 | 34·85 | 12·27 | 0·94 |
| October | 34·78 | 12·90 | 0·92 | 34·74 | 9·41 | 1·78 |
| November | 34·72 | 11·14 | 1·06 | 34·70 | 10·88 | 1·33 |
| December | 34·69 | 14·33 | 0·29 | 34·72 | 9·88 | 1·43 |



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area, however, shows that a high percentage blew from easterly and southerly directions. In these circumstances considerable upwelling must have occurred which occasioned adequate nutrient salts for the phytoplankton bloom. It is probable, therefore, that the phosphate content would have been much higher during that month if no phytoplankton had been present. There is in fact a considerable rise in the phosphate content from June to July. During the latter month phytoplankton was very scarce. It should also be borne in mind that there are various factors such as solar radiation, water temperature, sea conditions, upwelling and the rate at which zooplankton consumes phytoplankton, which affect the relationship between the phosphate and phytoplankton. Furthermore phosphate is not the only nutrient salt by means of which the phytoplankton is sustained.

25 *metres.*

The maximum (1·97 mg-atom $P/m^3$) and minimum (0·88 mg-atom $P/m^3$) phosphate contents were recorded in January and June respectively. As in the case of the previous depth, a comparison of the graphs of the phosphate content and phytoplankton (20 metres) reveals a definite correlation. During the months of January, February, March and April when the phosphate content was relatively high, only a negligible volume of phytoplankton was present at 20 metres. From March to June a gradual decline in phosphate content occurred. When the phosphate content dropped to a minimum level in June, a considerable increase occurred in the phytoplankton.

During July and August there was an increase in the phosphate content accompanied by a considerable decrease in the phytoplankton. This relationship between the increase in phosphate and decrease in total phytoplankton was also observed during the months of September, October and November. During December a rise was recorded in the phosphate content as well as in the total phytoplankton volume. This inconsistency may possibly be ascribed to the fact that upwelling occurred during that month and that the phytoplankton, of which abundant quantities were already present during November, rapidly increased under the favourable conditions of plentiful sunshine (see later).

**(iii) Temperature.**

0 *metres.*

The maximum (16·57°C.) and minimum (11·14°C.) temperatures were recorded in March and November, respectively. The temperature and phosphate curves at this depth show a definite correlation; a rise in phosphate content is consistently associated with a drop in temperature. There is no definite correlation between surface temperature and total phytoplankton. The range of temperature at which heavy phytoplankton blooms were observed, varied from 11·14°C. to 14·33°C. A relatively small phytoplankton bloom was recorded during March when the surface temperature was 16·57°C.

It is difficult to correlate a phytoplankton bloom with the surface temperature as the latter is dependent upon so many factors such as absorption of solar energy, prevailing winds, tidal influences, etc.

25 *metres.*

The temperature at this depth is not greatly influenced by the above-mentioned factors (influence of winds, sun, etc.) and gives a clearer indication of the relationship between phytoplankton bloom and temperature.

The maximum temperature (13·71°C.) was recorded during May and the minimum (9·11°C.) during January. During June the temperature (13·66°C.) closely approximated the maximum value and during February (9·81°C.), October (9·41°C.) and December (9·88°C.) it was close to the minimum value.

A gradual rise in temperature occurred from January to May when maximum values were reached. With the exception of October when a relatively sharp rise was recorded, and November when a moderate increase occurred, the temperature decreases from the winter season to reach the minimum value during the summer season. The curves (Fig. 2) of total phytoplankton show that phytoplankton is most abundant during spring and summer and occurs in much smaller volumes during the autumn and winter seasons. The temperature curve (Fig. 3) of this depth indicates that during the seasons when phytoplankton is relatively scarce (autumn and winter), the temperature is relatively high and, *vice versa*, when abundant quantities of phytoplankton occur, the temperature is relatively low. At the surface the temperature is generally higher during the spring and summer seasons as a result of increased solar radiation. From the temperature curve of the 25 metre depth, therefore, it is apparent that during the spring and summer seasons upwelling occurred; as a result of this phytoplankton was provided with more nutrient salts (see *Upwelling*). The surface temperatures are higher during spring and summer and therefore provide excellent conditions for the growth of phytoplankton which thrives mainly in the 0 to 20 metre layer.

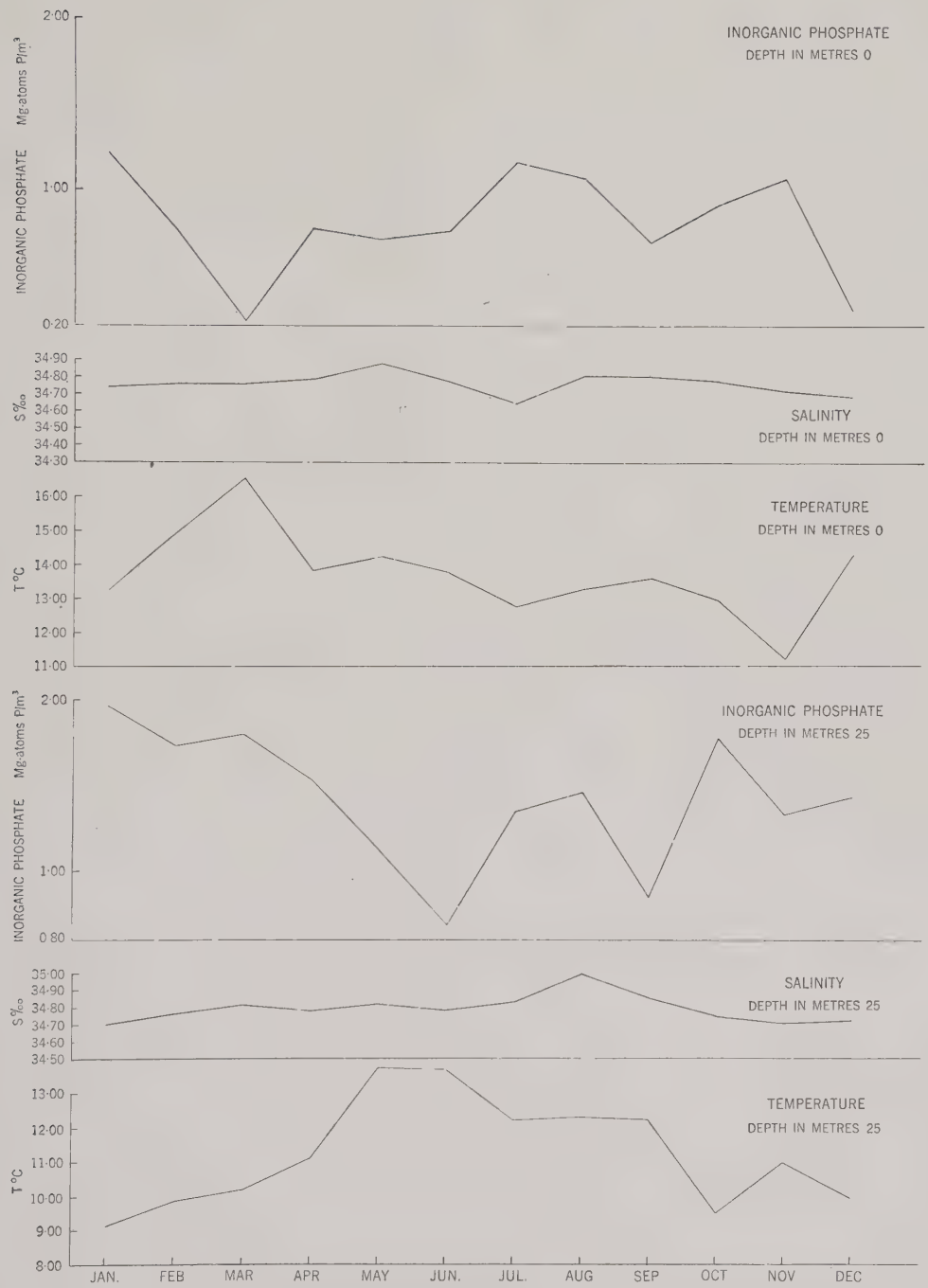


FIG. 3. SEASONAL VARIATION OF INORGANIC PHOSPHATE, SALINITY AND TEMPERATURE AT 0 AND 25 METRES, STATION DA, 1954.

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The temperature and phosphate curves at 25 metres show a close relationship, similar to that at the surface.

**(iv) Salinities.**

0 *metres.*

The maximum salinity (34·87‰) was recorded in May and the minimum (34·65‰) in July. There was, however, little difference between the minimum and maximum values. From May to July a decline in salinity occurred. From May to July there was an increase in the inorganic phosphate content (Fig. 3). This increase in phosphate and decrease in salinity may possibly be ascribed to the influence of fresh water flowing from rivers into the bay. As stated before, the winter season of 1954 was characterized by particularly heavy rainfall.

25 *metres.*

As in the case of the surface, the salinity at 25 metres was generally fairly constant. The maximum salinity (34·99‰) was recorded in August and the minimum salinity (34·70‰) during January and November. Large quantities of phytoplankton were found at 20 metres. During these months when phytoplankton was present, (page 9) the salinity varied from 34·70‰ to 34·85‰. The heaviest bloom was recorded during December when the salinity was 34·72‰. During August when the maximum salinity was 34·99‰, phytoplankton was very sparse. Phytoplankton was therefore more abundant when the salinity was relatively lower, but it should be noted that the salinity was fairly constant throughout the year.

**(v) The Depth Distribution of Phytoplankton Genera at Station DA—Quantitative Aspect.**

The following genera were recorded in the counts at station DA during 1954:—

*Chaetoceros*, *Nitzschia*, *Thalassiosira*, *Skeletonema*, *Ceratium*, *Prorocentrum*, *Pleurosigma*, *Leptocylindrus*, *Dinophysis*, *Peridinium*, *Coscinodiscus*, *Schröderella*, *Asterionella*, *Biddulphia*, *Thalassionema*, *Hemiaulus*, *Planktoniella*, *Corethron* and *Rhizosolenia*.

The following are notes on the abundance and depth distribution of the genera concerned. Every occurrence of each genus is mentioned.

(*a*) *Chaetoceros.*

*January*, 1954.—The distribution of this important genus was between 0 and 10 metres. The maximum number of cells/litre (122,500 cells) was recorded at 5 metres. At 5 and 10 metres *Chaetoceros* was the dominant genus (Tables 15 and 16). The temperatures at 0 and 25 metres were 13·37°C. and 9·11°C. respectively.

*June*, 1954.—*Chaetoceros* was distributed at a greater depth (between 0 and 30 metres) than during January. The maximum number of cells/litre (37,500 cells) was recorded at the surface. Not only were fewer cells/litre recorded than during January, but the genus constituted only a small percentage (Table 14) of the total phytoplankton genera for this month.

The temperatures at 0 and 25 metres were 13·73°C. and 13·66°C. respectively.

*September*, 1954.—During September *Chaetoceros* was distributed between 0 and 20 metres, and the maximum number of cells/litre (790,000 cells) was recorded at 10 metres. During this month *Chaetoceros* was the dominant genus (Tables 14–17). The temperatures at 0 and 25 metres were 13·52°C. and 12·27°C. respectively.

*October*, 1954.—Small numbers (10,000 cells/litre) were found at 0 metres only. The genus constituted but a small percentage of the phytoplankton catches for this month (Table 14). The temperatures at 0 and 25 metres were 12·90°C. and 9·41°C. respectively.

*November*, 1954.—*Chaetoceros* was distributed between 0 and 30 metres and the maximum number of cells/litre (807,500 cells) occurred at 10 metres.

*Chaetoceros* was the dominant genus in the phytoplankton catches for this month and accounted for a very high percentage of the catches (Tables 14–18). The temperatures recorded at 0 and 25 metres were 11·14°C. and 10·88°C. respectively.

*December*, 1954.—During December *Chaetoceros* was distributed over the entire depth range 0–50 metres). The maximum number of cells/litre (3,657,500 cells) occurred at 20 metres. As in November, *Chaetoceros* was the dominant genus found in the catches (Tables 14–19). The temperatures recorded at 0 and 25 metres were 14·33°C. and 9·88°C. respectively.

*Chaetoceros* was recorded at station DA during six months of the year. During four of the six months it was the dominant genus in the catches and especially during November and December this genus constituted a very high percentage of the phytoplankton catches. The greatest number of cells/litre of this genus occurred between 0 and 20 metres. During November this genus was also present at 30 metres and in December *Chaetoceros* was distributed over the entire depth range.

TABLE 2.

STATION DA, 1954.

| 1954. | Total Number of Cells in the 0–20 Metre Layer*. | | | | | | Average value of Observations at 0 and 25 Metres. | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Chaetoceros.* | *Nitzschia.* | *Thalassiosira.* | *Skeletonema.* | *Ceratium.* | *Prorocentrum.* | T°C. | P mg–atoms/M³. | S‰. |
| January..... | 267,500 | 45,000 | 10,000 | — | 135,000 | — | 11·24 | 1·59 | 34·72 |
| February..... | — | — | — | — | — | — | 12·39 | 1·25 | 34·76 |
| March..... | — | — | — | — | 32,500 | 50,000 | 13·37 | 1·01 | 34·79 |
| April..... | — | — | — | — | — | — | 12·45 | 1·15 | 34·79 |
| May..... | — | — | — | — | — | — | 13·97 | 0·91 | 34·85 |
| June..... | 72,500 | 240,000 | 742,500 | — | — | 2,500 | 13·69 | 0·83 | 34·78 |
| July..... | — | — | — | — | — | — | 12·51 | 1·26 | 34·74 |
| August..... | — | — | — | — | — | — | 12·88 | 1·27 | 34·90 |
| September... | 2,695,000 | 610,000 | 635,000 | — | — | 2,500 | 12·89 | 0·82 | 34·83 |
| October..... | 10,000 | 60,000 | 35,000 | 92,000 | — | — | 11·15 | 1·35 | 34·76 |
| November... | 2,310,000 | 12,500 | 90,000 | — | — | — | 11·01 | 1·19 | 34·71 |
| December... | 9,435,000 | 55,000 | 10,000 | — | — | 7,500 | 12·11 | 0·86 | 34·71 |

* 1 Litre sample at each of the following depths: 0, 5, 10 and 20 metres.

Table 2 shows that the total number of cells/litre occurring in the 0 to 20 metre layer exceeded the one million mark during September, November and December. During these months the temperature and salinity of the 0–25 metre layer (Table 2) varied from 11·01°C. to 12·89°C., and 34·71‰ to 34·83‰ respectively. The phosphate content of the same layer varied from 0·82–1·19 mg.-atoms P/m³. The largest number of cells/litre (9,435,000) (Table 2) was recorded during December when the temperature at 0 and 25 metres averaged 12·11°C. The salinity and phosphate content values were 34·71‰ and 0·86 mg.-atoms P/m³ respectively. From November onwards, when already large quantities of phytoplankton (2,310,000 cells/litre) were present in the 0–20 metre layer at this station, a considerable rise in the surface temperature and a tremendous decrease in phosphate content (Table 1) occurred in December. At 25 metres a drop in temperature and a considerable increase in phosphate content occurred (Table 1). It is clear that upwelling occurred in December (see section on Upwelling) and that a very heavy *Chaetoceros* bloom occurred under these most favourable conditions. It is evident, therefore, that this genus can greatly increase in numbers in recently upwelled water.

During June and October, when *Chaetoceros* constituted but an insignificant percentage of phytoplankton catches (Tables 14–19), the surface temperatures and salinities were relatively high while the phosphate content of the surface was comparatively low. As *Chaetoceros* formed but a small percentage of the catches it may reasonably be assumed that the phosphate was used mainly by the other genera (see later) during the months mentioned. During the months of November and December, especially when *Chaetoceros* constituted such a high percentage of the catches, this genus in particular was responsible for the consumption of phosphate.

*Chaetoceros* is the most important nutrient diatom in the phytoplankton succession in St. Helena Bay and was dominant in the catches made during the months when the process of upwelling was most marked (see Upwelling).

As net catches give only rough indications of the quantitative abundance of a genus, the following symbols (Fig. 4) are used to indicate quantities:—

A = occurrence of genus *very abundant.*

C = occurrence of genus *abundant.*

R = genus present but in *small numbers.*

According to surface catches (N50V) made at station DA, the seasonal variation of *Chaetoceros* was as follws:—

During eleven months of the year *Chaetoceros* was present in the net catches. During November and December this genus was *very abundant* an during June and September it was *abundant. Chaetoceros* was absent from the catches only during February.

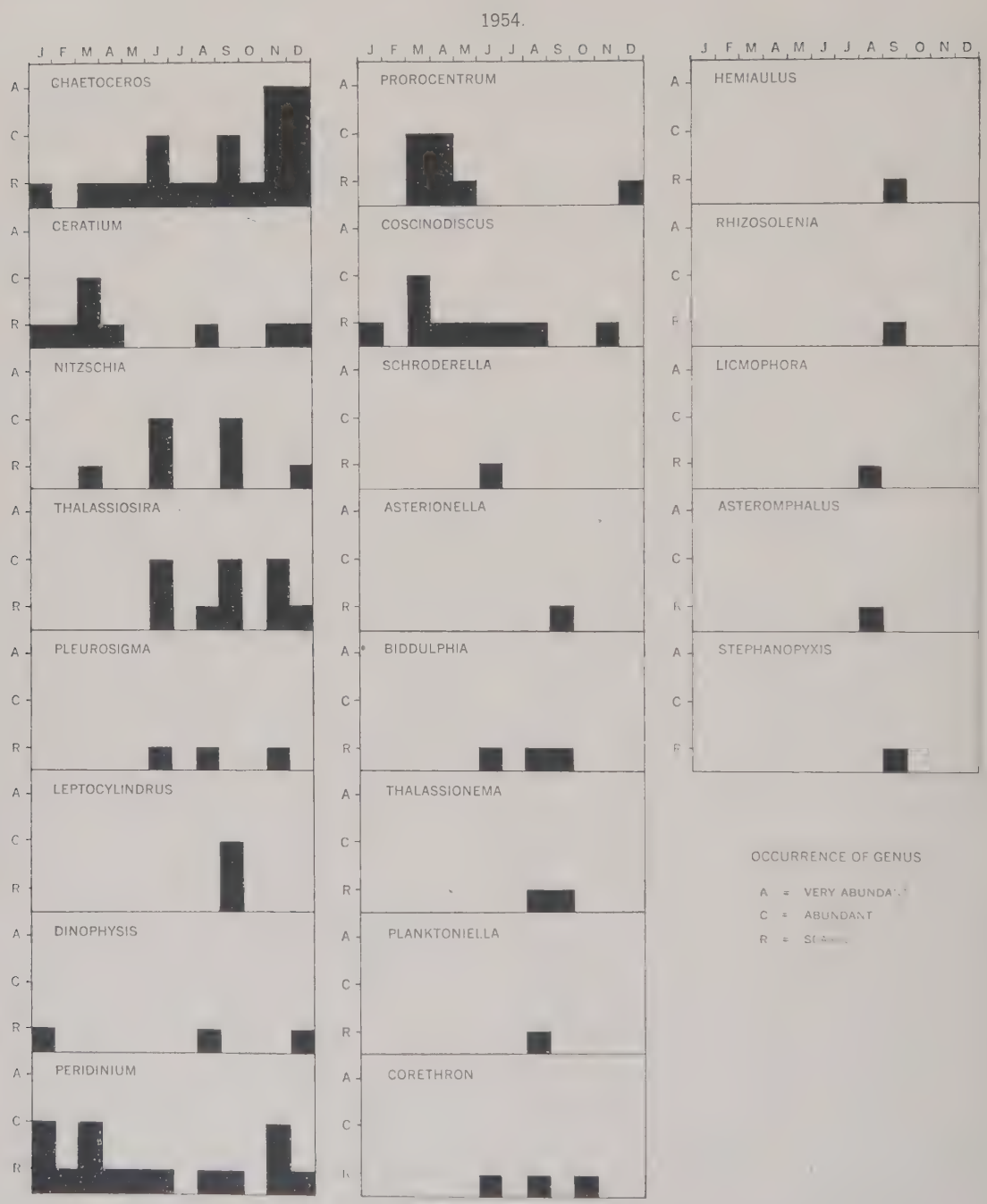


FIG. 4. SEASONAL OCCURRENCE OF PHYTOPLANKTON GENERA (ACCORDING TO N50V. 50-0 METRES) AT STATION DA, 1954

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As reflected by the counts and net catches, this genus was *most abundant* during the *spring and summer seasons*, *less abundant* during the *winter season* and *rare* during the *autumn season*.

(*b Thalassiosira*.

*January*, 1954.—Small numbers of this genus were unequally distributed between 0 and 10 metres. The temperatures recorded at 0 and 25 metres were 13·37°C. and 9·11°C. respectively. *Thalassiosira* constituted only a small percentage of the catches made during this month (Tables 14–16).

*June*, 1954.—During June *Thalassiosira* was distributed between 0 and 50 metres. The maximum number of cells/litre was recorded at 10 metres, while good quantities (222,500 cells/litre) were also recorded at 30 metres. It was unevenly distributed. The temperatures at 0 and 25 metres were 13·73°C. and 13·66°C. respectively. At all depths between 0 and 50 metres *Thalassiosira* was the dominant genus in the catches for this month (Tables 14–19). At 50 metres only *Thalassiosira* was found.

*September*, 1954.—There was a fairly even distribution of the genus in the 0 to 10 metre layer with a sharp decrease in numbers at 20 metres. The maximum number of cells/litre (185,000 cells) was recorded at 0 metres. The temperatures at 0 and 25 metres were 13·52°C. and 12·27°C., respectively. *Thalassiosira* accounted for a considerable percentage of the phytoplankton catches made during this month (Tables 14–16).

*October*, 1954.—This genus occurred only at 0 and 5 metres and the maximum number of cells/litre (25,000 cells) was recorded at 5 metres. The temperatures at 0 and 25 metres were 12·90°C. and 9·41°C. respectively. Catches made during this month contained only a very small percentage of *Thalassiosira* (Tables 14–15).

*November*, 1954.—During November *Thalassiosira* was unevenly distributed between 0 and 50 metres. The maximum number of cells/litre (35,000 cells) was found at 5 metres. The temperatures recorded at 0 and 25 metres were 11·14°C. and 10·88°C., respectively. As in the case of the previous month *Thalassiosira* constituted only a small percentage of the catches.

*December*, 1954.—The genus occurred only in insignificant numbers during this month and therefore constituted a very small proportion of the catches. *Thalassiosira* was found only at 10 and 20 metres (only 5,000 cells/litre at these depths). The temperatures at 0 and 25 metres were 14·33°C. and 9·88°C., respectively.

*Thalassiosira* occurred at this station during six months of the year, viz., during January, June, September, October, November and December. During these months *Chaetoceros* was also present, but Table 2 clearly indicates that the latter genus appeared in much larger numbers than *Thalassiosira*. Only during July and October did *Thalassiosira* occur in larger volumes than *Chaetoceros*. It is interesting to note that apparently no large-scale upwelling occurred during June and October. A *Thalassiosira* bloom therefore occurred during the months characterized by the apparent absence of large-scale upwelling, while the opposite applies in the case of *Chaetoceros*.

During June when the heaviest *Thalassiosira* bloom was recorded, the average temperature and salinity at 0 and 25 metres were relatively high (Table 2), while the phosphate content was relatively low. During this month the genus was distributed between 0 and 50 metres and dominated all other genera in the catch. It is possible, therefore, that a *Thalassiosira* bloom occurred after upwelled water had become warmer; this in contrast to *Chaetoceros* which can bloom in recently upwelled water. During September when *Thalassiosira* also occurred in vast quantities, the temperature and salinity was relatively high and the phosphate content was relatively low (Table 2).

*Thalassiosira* was the dominant genus in the catches during June only, but during September this genus also constituted a considerable proportion of the catch. The genus was therefore *most abundant* during one month of the *winter* season, *abundant* during one month of the *spring* season, *less abundant* during the *summer* season and *absent* during the *autumn* season of 1954.

In the net catches (N50V) abundant quantities of *Thalassiosira* occurred during three months of the year, viz., in June, September and November. In August and December only small numbers were found in the net catches.

(*c*) *Nitzschia*.

*January*, 1954.—During January this genus was distributed in the 0 to 10 metre layer. The maximum number of cells/litre (20,000 cells) was recorded at 0 metres. *Nitzschia* did not constitute a large percentage of the catches made during this month (Table 14). The temperatures at 0 and 25 metres were 13·37°C. and 9·11°C., respectively.

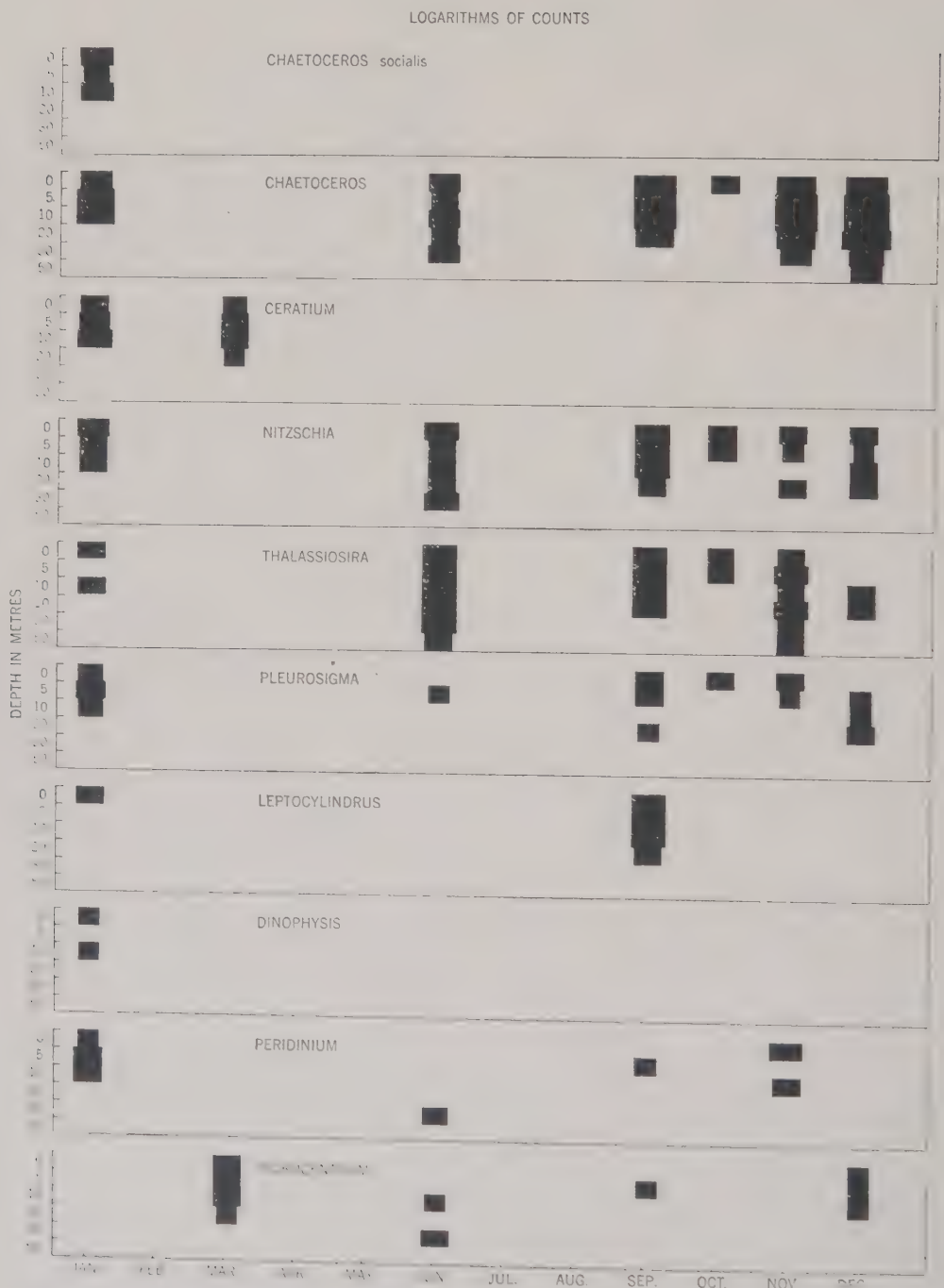


FIG. 5 SEASONAL AND DEPTH DISTRIBUTION OF PHYTOPLANKTON AT STATION DA. 1954.

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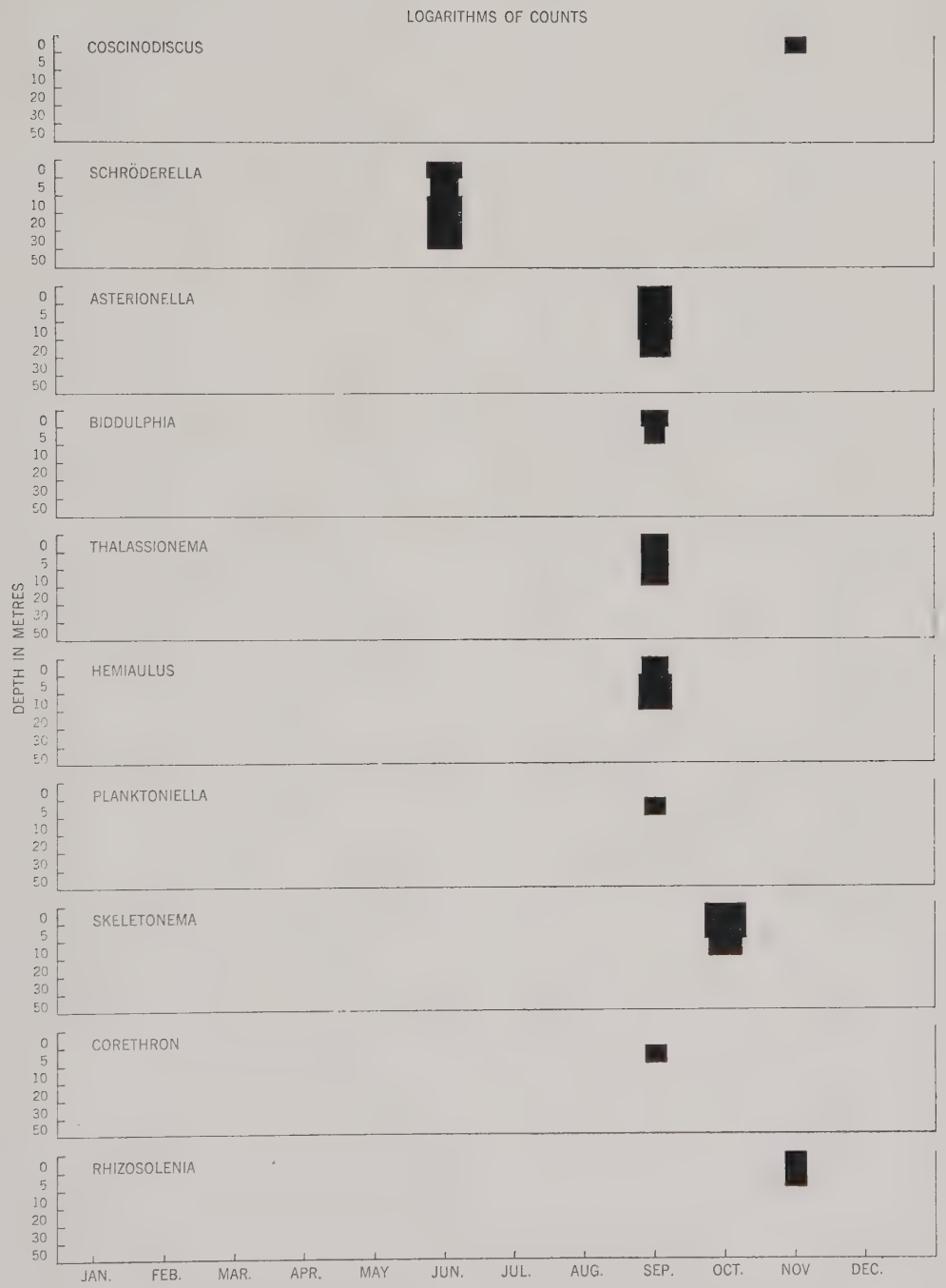


FIG. 6 SEASONAL AND DEPTH DISTRIBUTION OF PHYTOPLANKTON AT STATION DA, 1954.

(LOGARITHMS OF COUNTS.)

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*June*, 1954.—The genus had a deeper distribution than during January, namely between 0 and 30 metres. The maximum number of cells/litre (112,500 cells) was found at 0 metres; at 30 metres 87,500 cells/litre were recorded. Between 0 and 30 metres varying numbers were recorded. *Nitzschia* constituted a considerable percentage of the catches made during June (Tables 14–18). The temperatures at 0 and 25 metres were 13·73°C. and 13·66°C. respectively.

*September*, 1954.—During September *Nitzschia* was distributed between 0 and 20 metres; the maximum number of cells/litre (247,500 cells) was recorded at 5 metres. From this depth to 20 metres there was a gradual decrease in numbers. As was the case in June, *Nitzschia* once again accounted for a large proportion of the catches, as is shown in Tables 14–17. The temperatures recorded at 0 and 25 metres were 13·52°C. and 12·27°C., respectively.

*October*, 1954.—The genus was distributed in the 0 to 5 metre layer only, with the maximum number of cells/litre (35,000 cells) concentrated at 0 metres. During October *Nitzschia* constituted but a small percentage of the catches. The temperatures at 0 and 25 metres were 12·90°C. and 9·41°C., respectively.

*November*, 1954.—Only a small quantity of the genus occurred at 0, 5 and 20 metres. *Nitzschia* therefore constituted an insignificant proportion of the catches. The temperatures recorded at 0 and 25 metres were 11·14°C. and 10·88°C., respectively.

*December*, 1954.—*Nitzschia* was distributed between 0 and 20 metres. The maximum number of cells/litre (27,500 cells) was found at 10 metres. *Nitzschia* constituted a small percentage of the catches made during this month. The temperatures at 0 and 25 metres were 14·33°C. and 9·88°C., respectively.

The genus appeared in the counts six times during the course of the year and was distributed mainly between 0 and 20 metres; only once was *Nitzschia* recorded at 30 metres. The heaviest bloom of the genus was recorded during September (Table 2) when the average temperature and salinity at 0 and 25 metres were relatively high and the phosphate content was low. In November, when the temperature and salinity was relatively lower (Table 2), small quantities were recorded. It appears that *Nitzschia*, like *Thalassiosira*, occurred in greater quantities during the months of June and September when upwelling occurred on a smaller scale. In this connection it should be noted that this genus never completely dominated the other genera, but constituted considerable percentages of the catches during only two months of the year. *Nitzschia* was not present in the counts taken during February, March, April, May, July and August. The winter, spring and summer seasons were therefore the most favourable for this genus while autumn was a poor season.

In the net catches (N50V) *Nitzschia* was abundant during June and September but only small quantities were found in March and December. As in the case of the counts, the best months for this genus were therefore September and June.

(*d*) *Skeletonema.*

This genus was recorded at this station only during October. The distribution was between 0 and 10 metres and the maximum number of cells/litre (435,000 cells) was recorded at 0 metres. *Skeletonema* was the dominant genus in the catches made during this month when the temperatures recorded at 0 and 25 metres were 12·90°C. and 9·41°C., respectively.

This genus was recorded in vast quantities at the southern station (DB) (see under DB) during October. It is possible, therefore, that *Skeletonema* had a very wide distribution in the St. Helena Bay area during October. Despite the fact that this genus was dominant in the count it was never recorded in the net catches made at station DA. It should however be borne in mind that *Skeletonema* is a very small organism and was possibly not present in large enough quantities not to escape through the meshes of the nets.

(*e*) *Ceratium*:

*January*, 1954.—*Ceratium* was distributed between 0 and 10 metres and increased in numbers with an increase in depth. The maximum number of cells/litre (57,500 cells) was found at 10 metres. This genus represented a considerable percentage of the catch made during January and was one of the dominant genera (Tables 14–16). The temperatures recorded at 0 and 25 metres were 13·37°C. and 9·11°C., respectively.

*March*, 1954.—Smaller numbers were recorded during this month than during January but the distribution was at a greater depth. *Ceratium* was distributed between 0 and 20 metres and the maximum number of cells/litre (12,500 cells) was recorded at 5 metres.

*Ceratium* was one of the dominant genera in the catch which comprised only 3 Protozoon genera (Tables 14–18). The temperatures at 0 and 25 metres were 16·57°C. and 10·17°C., respectively. The heaviest bloom of this genus at this station

therefore occurred during January when upwelling took place (see Upwelling). Surface temperatures were relatively high and in January and March the temperatures at 25 metres were relatively low (Table 1)—indicating upwelling. In the net catches (N50V) *Ceratium* was abundant only during March. During January, February, April, August, November and December the genus occurred in small quantities.

(*f*) *Prorocentrum.*

*March*, 1954.—*Prorocentrum* was distributed between 0 and 20 metres and the maximum number of cells/litre was recorded at 0 metres (30,000 cells). Volumes gradually decreased from 0 to 20 metres. This genus was dominant at 0 and 5 metres (Tables 14–18). During the routine voyage when the samples were obtained at this station the entire northern part of the commercial fishing area was characterised by the presence of " red water " consisting mainly of *Prorocentrum*. It appeared to have had no adverse effects on the fish population. The temperatures recorded at 0 and 25 metres were 16·57°C. and 10·17°C., respectively, reflecting a considerable difference in temperatures. It is interesting to note that *Prorocentrum* was more abundant at the surface where the temperature was so much higher.

*June*, 1954.—Only small numbers of this genus were recorded at 10 and 30 metres and it therefore constituted a very small percentage of the catches for this month (Tables 16 and 18). The temperatures at 0 and 25 metres were 13·73°C. and 13·66° C., respectively.

*September*, 1954.—Small quantities of *Prorocentrum* (2,500 cells/litre) were found at 5 metres and this genus accounted for but a small proportion of the catch. The temperatures at 0 and 25 metres were 13·52°C. and 12·27°C., respectively.

*December*, 1954.—This genus again occurred in small numbers at 0 and 10 metres. The temperatures recorded at 0 and 25 metres were 14·33°C. and 9·88°C., respectively.

Despite the fact that *Prorocentrum* was recorded in counts made during four months of the year, this genus occurred in noteworthy quantities only during March and was widely distributed over the northern part of St. Helena Bay. The distribution occurred mainly at 0 metres during a month when the surface temperature at this station reached a maximum value of 16·57°C.

In the net catches (N50V) *Prorocentrum* was abundant during March and April, and the genus was present but scarce during May and December.

(*g*) *Pleurosigma.*

*January*, 1954.—*Pleurosigma* was found only in small quantities in the 0–10 metre layer. The maximum number of cells/litre (only 7,500 cells) was found at 5 metres. The temperatures at 0 and 25 metres were 13·37°C. and 9·11°C., respectively. This genus represented but a small percentage of the catch for this month (Tables 14–16).

*June*, 1954.—Small volumes of this genus were recorded at 5 metres only (2,500 cells/litre). The temperatures recorded at 0 and 25 metres were 13·73°C. and 13·66°C., respectively.

*September*, 1954.—Once again this genus appeared only in small quantities at 0, 5 and 20 metres. The maximum number of cells/litre (only 5,000 cells) occurred at 0 and 5 metres. The temperatures at 0 and 25 metres were 13·52°C. and 12·27°C., respectively.

*October*, 1954.—During this month *Pleurosigma* occurred only at 0 metres and again in small quantities (5,000 cells/litre). The temperatures at 0 and 25 metres were 12·90°C. and 9·41°C., respectively. The genus constituted only 1 per cent of the catch made at 0 metres.

*November*, 1954.—Only small numbers of the genus were recorded in the 0–5 metre layer (5,000 cells/litre at 0 metres). The temperatures recorded at 0 and 25 metres were 11·14°C. and 10·88°C., respectively. *Pleurosigma* accounted for an insignificant proportion of the catch (Tables 14–15).

Only small volumes of *Pleurosigma* were recorded during January, June, September, October, and November. The genus was distributed mainly in the 0–5 metre layer and constituted only small percentages of the catches made during those months.

In the net-catches (N50V) this genus occurred in small quantities during June, August and November.

(*h*) *Leptocylindrus.*

*January*, 1954.—Small quantities of this genus (7,500 cells/litre were recorded at 0 metres only during January. *Leptocylindrus* constituted 4 per cent of the catch made at this depth (Table 14). The temperatures at 0 and 25 metres were 13·37°C. and 9·11°C. respectively.

*September*, 1954.—This genus was unevenly distributed between 0 and 20 metres. The maximum number of cells/litre (110,000 cells) was recorded at 10 metres. *Leptocylindrus* constituted 7 per cent of the catch made at 10 metres (Table 15). The temperatures at 0 and 25 metres were 13·52°C. and 12·27°C., respectively.

Only once during the year was this genus found in the net catches, i.e. in September when considerable quantities were recorded (Fig. 4).

According to the count and net catches, *Leptocylindrus* was recorded only twice during 1954. The largest numbers were recorded during September when the average temperature at 0 and 25 metres was 12·89°C. During January when small quantities were recorded, the average temperature was lower, namely 11·24°C. Much smaller numbers were therefore recorded when upwelling occurred (see Upwelling).

(*i*) *Dinophysis.*

This genus was recorded only once during the year, viz., in January when very small numbers (2,500 cells/litre) were recorded at 10 and 30 metres, respectively. *Dinophysis* therefore accounted for an insignificant percentage of the catches (Tables 14–18). The temperatures at 0 and 25 metres were 13·37°C. and 9·11°C., respectively.

In the net catches *Dinophysis* occurred in small numbers during January, August and November.

(*j*) *Peridinium.*

*January*, 1954.—Small volumes of *Peridinium* were found at 0, 5 and 10 metres. The maximum number of cells/litre (only 5,000 cells) was recorded at 5 and 10 metres. This genus constituted a very small percentage of the catch. The temperatures at 0 and 25 metres were 13·37°C. and 9·11°C., respectively.

*June*, 1954.—During June this genus was found only at 30 metres (5,000 cells/litre) and it constituted but a small proportion of the catch. The temperatures recorded at 0 and 25 metres were 13·73°C. and 13·66°C., respectively.

*September*, 1954.—*Peridinium* occurred at 5 metres only (5,000 cells/litre) and once again accounted for but an insignificant percentage of the catch. The temperatures at 0 and 25 metres were 13·52°C. and 12·27°C., respectively.

*November*, 1954.—During November the largest number of cells/litre were recorded for this genus. *Peridinium* was distributed between 0 and 10 metres and the maximum number of cells/litre (17,500 cells) was recorded at 0 metres. At this depth *Peridinium* represented 5 per cent of the catch and was the most important genus in the catch next to *Chaetoceros*. The temperatures at 0 and 25 metres were 11·14°C. and 10·88°C., respectively.

*December*, 1954.—Only very small volumes of *Peridinium* (2,500 cells/litre) occurred at 10 metres during December and the genus constituted a small proportion of the catch. The temperatures at 0 and 25 metres were 14·33°C. and 9·88°C., respectively.

The largest quantities of *Peridinium* were therefore recorded during November when the average temperature of the 0–25 metre layer was relatively low (11·01°C.) (Table 2) and upwelling occurred. During January, June, September and December this genus appeared in very small numbers and therefore did not form a large percentage of the catches. *Peridinium* was distributed mainly in the 0–10 metre layer and was recorded at 20 metres only once.

In the net catches (N50V) *Peridinium* occurred during ten months of the year; only during July and October was it completely absent. Abundant volumes of the genus occurred in the net catches during January, March and November; during the remaining months only small numbers were recorded.

(*k*) *Coscinodiscus.*

*Coscinodiscus* was recorded only during November in the counts taken at 0 metres. This genus occurred in very small quantities (2,500 cells/litre) and formed a small component of the catch at the depth mentioned. The temperatures recorded at 0 and 25 metres were 11·14°C. and 10·88°C., respectively.

It is interesting to note that *Coscinodiscus* occurred in the net catches (N50V) during eight months of the year. This genus was absent from the net catches only during February, September and October. Large quantities of *Coscinodiscus* were recorded in the net catches only during March. During the other months of occurrence, the quantities were always small. A possible explanation for the fact that *Coscinodiscus* was more often recorded in the net catches than in the counts, is that these organisms are relatively large compared with others, thus creating the impression of abundant quantities in relation to other organisms occurring in the net catches where analyses are not strictly quantitative. As mentioned before the frequency of occurrence of *Coscinodiscus* in the nets was high, but the numbers were relatively high only once during the year.

(*l*) *Schröderella.*

This genus was recorded only during June and was distributed between 0 and 30 metres, the maximum number of cells/litre (82,500) being recorded at 30 metres. During June this genus accounted

for a considerable percentage of the catch. The temperatures at 0 and 25 metres were 13·73°C. and 13·66°C., respectively.

The genus therefore occurred in large quantities only once during the year when the average temperature of the 0 to 25 metre layer was relatively high (13·69°C.) and when there were no definite indications of upwelling.

In the net catches (N50V) *Schröderella* occurred only in small quantities during June, which was the only time this genus was found in the nets.

(*m*) *Asterionella.*

*Asterionella* was recorded in the counts only during September and was distributed in the 0–20 metre layer, the maximum number of cells/litre (157,500 cells) being found at 5 metres. This genus represented a considerable proportion of the catches made in this layer. The temperatures at 0 and 25 metres were 13·52°C. and 12·27°C., respectively.

Only during September was *Asterionella* found in the nets and then only in insignificant quantities.

(*n*) *Biddulphia.*

This genus was recorded at this station only during September and was distributed in the 0 to 5 metre layer. The maximum number of cells/litre (15,000 cells) was not high and was recorded at 0 metres. *Biddulphia* constituted but a small percentage of the catch made during September. The temperatures recorded at 0 and 25 metres were 13·52°C. and 12·27°C., respectively.

Small quantities of this genus occurred in the net catches (N50V) made during June, August and September.

(*o*) *Thalassionema.*

This genus was distributed in small quantities in the 0 to 10 metre layer during September only. The maximum number of cells/litre (10,000 cells) was recorded at 0 and 5 metres. *Thalassionema* formed a very small percentage of the catches (Tables 14–16). The temperatures at 0 and 25 metres were 13·52°C. and 12·27°C., respectively.

Small quantities of this genus occurred in the net catches during August and September.

(*p*) *Hemiaulus.*

This genus was recorded between 0 and 10 metres only during September. There was a gradual increase in the number of cells/litre as the depth increased; the maximum number of cells/litre (62,500 cells) was recorded at 10 metres. *Hemiaulus* constituted a considerable proportion of the catch made during this month of the year (Tables 14–16).

The temperatures recorded at 0 and 25 metres were 13·52°C. and 12·27°C., respectively. Only small quantities of *Hemiaulus* were recorded in the net catches (N50V) during September.

(*q*) *Planktoniella.*

In September insignificant quantities of this genus (2,500 cells/litre) were recorded at 5 metres; this constituted a very small percentage of the total phytoplankton catch. The temperatures at 0 and 25 metres were 13·52°C. and 12·27°C., respectively.

*Planktoniella* was also scarce in the net catches and was recorded only during August.

(*r*) *Corethron.*

Only very small numbers of this genus (2,500 cells/litre) were recorded during November. The temperatures at 0 and 25 metres were 11·14°C. and 10·88°C., respectively.

Small quantities of *Corethron* occurred in the net catches (N50V) made during May, July and September.

(*s*) *Rhizosolenia.*

*Rhizosolenia* was recorded in the counts in November only and occurred in small numbers (2,500 cells/litre) in the 0–5 metre layer. This genus consequently constituted an insignificant percentage of the catch. The temperatures at 0 and 25 metres were 11·14°C. and 10·88°C., respectively. This genus was recorded in small numbers in the net catches only during September.

The following genera were never recorded in the counts during the course of the year, but were recorded in small quantities in the net catches.—

(*t*) *Licmophora.*

*Licmophora* was recorded only during August and in small quantities. The average temperature of the 0–25 metre layer was 11·15°C.

(*u*) *Asteromphalus.*

Small quantities of *Asteromphalus* were recorded during August. The average temperature of the 0 to 25 metre layer was 12·88°C.

(*v*) *Stephanopyxis.*

Only small numbers of this genus were recorded during September. The average temperature of the 0 to 25 metre layer was 12·89°C.

(w) *Chaetoceros socialis.*

This genus was recorded at station DA during January only. It was distributed in the 0 to 10 metre layer, the maximum number of cells/litre (65,000 cells) being recorded at 10 metres. During January *Chaetoceros socialis* was the dominant genus found at 0 metres (Table 14).

### (vi) Discussion.

During 1954 large quantities of phytoplankton were recorded at station DA, situated in the northern part of the commercial fishing area. During all three months (September, October and November) of the spring season large quantities of phytoplankton were found. During the summer season phytoplankton was abundant in December and January, but scarce during the third month of that season. During the winter season considerable quantities of phytoplankton were recorded only in June. During the autumn season comparatively small quantities were recorded only during March. Phytoplankton was therefore most abundant during the spring and summer, less abundant during the winter and comparatively scarce during the autumn.

Increased upwelling occurred mainly during spring and summer (see Upwelling). These seasons were also the most favourable for phytoplankton blooms. At this station there was a clear correlation between the quantitative occurrence of phytoplankton, certain hydrological factors (temperature, salinity and phosphate content) and physical factors (winds, upwelling, solar radiation, etc.). The occurrence of strong south-easterly winds during spring and summer has an indirect influence upon the abundance of phytoplankton as these winds promote the upwelling process, thus making more nutrient salts available for the growth of phytoplankton organisms. During these seasons, therefore, adequate nutrient salts are available for the sustenance of the phytoplankton. These seasons are also associated with abundant sunshine without which photosynthesis cannot take place.

These favourable environmental factors therefore promoted the growth of a large number of phytoplankton genera at station DA. Of these genera mentioned on page 12, the following were dominant in the catches one or more times during the year: *Chaetoceros*, *Thalassiosira*, *Prorocentrum*, *Nitzschia*, *Skeletonema* and *Ceratium*. The greatest number of genera was recorded during September. A large number of these genera was recorded during September only (Figs. 5 and 6). It is possible that some of these genera (such as e.g. *Planktoniella*) normally mainly occur farther offshore and that they were driven closer to the coast by favourable water movements. During the winter and early spring strong north-westerly winds occur in the commercial fishing area; it is possible, therefore, that these winds drive masses of water shorewards.

During 1954 the northern part of the commercial fishing area therefore contained a large number of phytoplankton genera which provided an important source of food for the pilchards.

## (b) DB (Fig. 1).

### (i) Total Phytoplankton Counts.

As in the case of station DA, the counts for the depths mentioned are discussed separately.

0 *metres.*

A phytoplankton bloom occurred during the months of January, February, March, June, August, September, October, November and December. Phytoplankton was therefore recorded at station DB during nine months of the year, as compared with seven months at station DA. During March, only small quantities were recorded. The volume of the bloom at station DB varied from 5,000 cells/litre in March to 3,057,500 cells/litre during October. This maximum number of cells/litre (3,057,500 cells) was therefore considerably higher than the maximum number of cells/litre (1,377,000 cells) recorded at station DA (0 metres) during September. As in the case of station DA, the spring season was not only the period during which maximum bloom was recorded, but also the season throughout which phytoplankton occurred in large quantities. At station DB, as in the case of station DA, the minimum bloom was recorded during autumn (March). A bloom occurred during June of the winter season when 187,500 cells/litre were recorded.

During spring and summer the most favourable conditions for a phytoplankton bloom prevailed at station DB. Phytoplankton concentrations were considerably lower during winter and very low during autumn.

Not only, therefore, was a larger number of cells/litre recorded at station DB, situated in the southern part of the fishing area, than at station DA (situated in the northern part of the fishing area), but considerable quantities of phytoplankton were also recorded at station DB during February

and August when phytoplankton organisms were very scarce at station DA.

5 *metres.*

The phytoplankton graph (Fig. 7) for this depth showed the same tendencies as those of the surface graph, except in respect of March when no phytoplankton was recorded. The maximum number of cells/litre (4,292,500 cells) was recorded during January and not in October as in the case of the surface. A much heavier bloom was therefore recorded for this depth during January than the maximum bloom recorded for the surface in October when 3,057,500 cells/litre were recorded. From September to October the number of cells/litre at this depth showed a decline; at the surface, however, there was an increase in the number of cells/litre during these months.

As in the case of the surface, the spring and summer seasons were at this depth the most favourable for phytoplankton blooms.

10 *metres.*

The phytoplankton curve corresponded with those for the previous depths. The maximum bloom (1,947,500 cells/litre) was, as at 5 metres, recorded during January. Although this was a heavy bloom, it was of smaller extent than those at the previous two depths.

The spring and summer seasons were also, at 10 metres, the most favourable for a phytoplankton bloom.

20 *metres.*

The graph (Fig. 7) of the total phytoplankton counts taken at this depth shows that considerable volumes of phytoplankton were found during January, February, June, August, September, November and December. At the corresponding depth at station DA large quantities of phytoplankton were recorded during only four months of the year (page 9).

As in the case of the previous two depths (5 and 10 metres) the maximum number of cells/litre (892,000 cells) for this depth was recorded during January. During October large quantities of phytoplankton were found in the abovementioned depths, while phytoplankton was particularly scarce at 20 metres.

As in the case of station DA, the most favourable conditions for the growth of phytoplankton at station DB also prevailed in the 0 to 20 metre layer. Only some of the dominant genera (Tables 20–25) were sometimes recorded at 30 and 50 metres.

### (ii) Inorganic Phosphate Content (Mg.-atoms $P/m^3$).

0 *metres.*

The maximum (1·61 mg.-atoms $P/m^3$) and minimum phosphate content (0·23 mg.-atoms $P/m^3$) were recorded during February and December, respectively. A gradual slight increase in the phosphate content occurred during the autumn season and into the winter season which was characterized by the occurrence of a relatively high phosphate content.

The phosphate content curve (Fig. 8) at this depth shows a definite correspondence with the curve of total phytoplankton counts; this correspondence is especially clear during the spring and summer seasons when phytoplankton is most abundant. Eight times during the course of the year an increase in total phytoplankton was accompanied by a decrease in phosphate content. During autumn and winter when phytoplankton was much scarcer than during spring and summer, a gradual regeneration of the surface phosphate, as stated above, occurred.

As in the case of station DA, a phytoplankton bloom was also recorded at station DB during June without a decrease in surface phosphate. One of the possible explanations for this inconsistency was discussed under station DA (page 9), namely that the increase in the surface phosphate from May to June (in the case of station DB, there was a considerable rise as compared with station DA where only a slight increase occurred) may possibly be ascribed to the fact that a heavy rainfall occurred in the area. The flooding of the Berg River may have had a local effect on the phosphate content in St. Helena Bay. Station DB is much closer to the mouth of the Berg River than station DA; the increase in phosphate content was, in fact, considerably greater at station DB than at DA.

On the whole a relationship between the increase in total phytoplankton and the decrease in phosphate content was also evident at this station.

25 *metres.*

The maximum (2·03 mg.-atoms $P/m^3$) and minimum phosphate content (0·59 mg.-atoms $P/m^3$) were recorded in February and October, respectively. In contrast to the surface the phosphate content at 25 metres was on the whole not only higher but also shows a seasonal variation (Fig. 7). The phosphate content at the surface was relatively low during the spring and summer seasons. This is understandable as it is in the

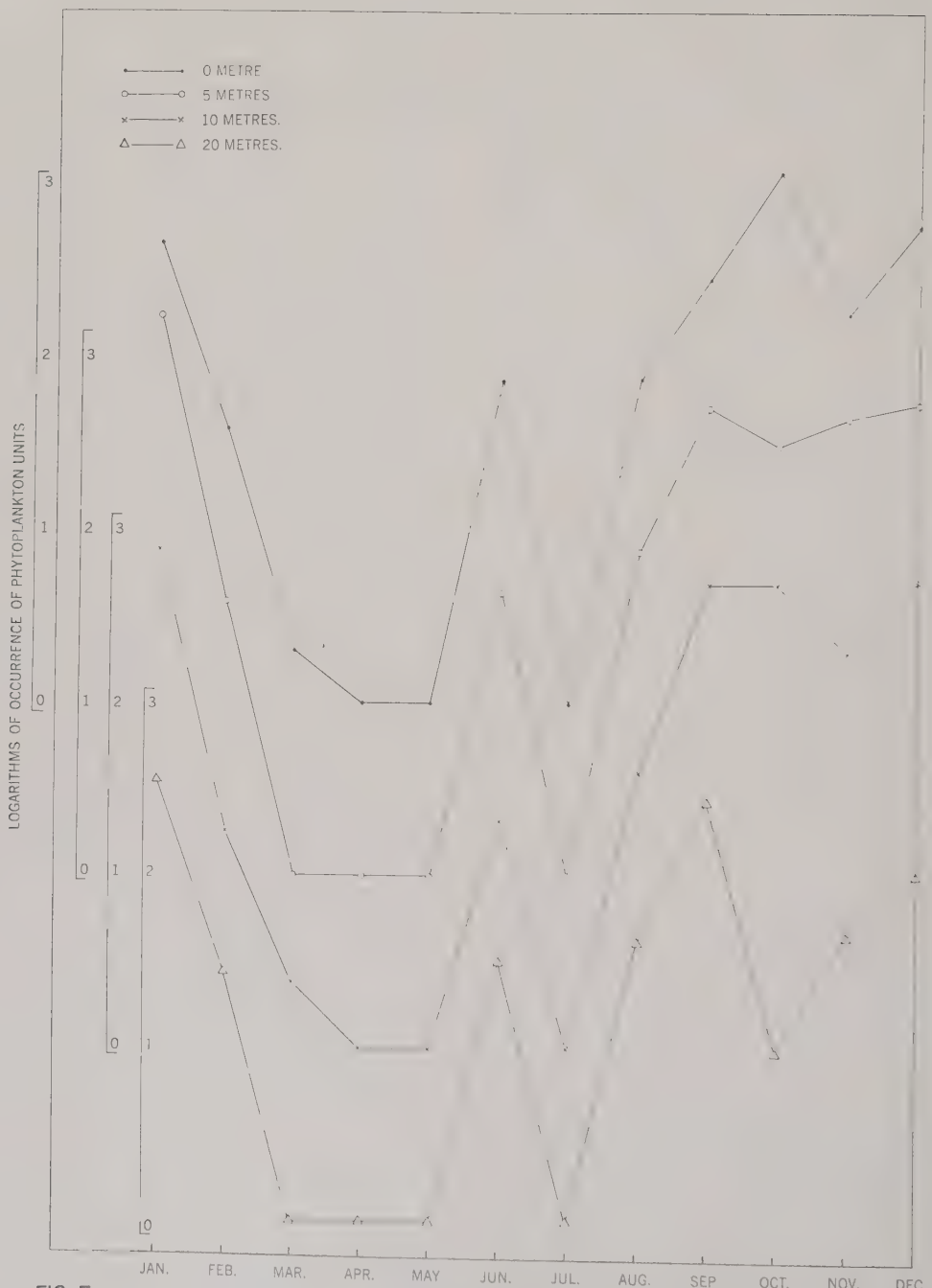


FIG .7 OCCURRENCE OF PHYTOPLANKTON UNITS AT 0, 5, 10 AND 20 METRES, STATION DB, 1954.

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upper part of the surface layer in particular that phytoplankton thrives under favourable conditions. During the autumn and winter seasons when upwelling occurs on a much smaller scale, the phosphate content at 25 metres is relatively lower (Table 3).

TABLE 3.

STATION DB.

| 1954. | 0 Metres. | | | 25 Metres. | | |
|---|---|---|---|---|---|---|
| Month. | S‰. | T°C. | P mg-atoms/m³. | S‰. | T°C. | P mg-atoms/m³. |
| January | 34·69 | 12·30 | 0·72 | 34·69 | 10·96 | 1·29 |
| February | 34·67 | 12·77 | 1·61 | 34·74 | 9·35 | 2·03 |
| March | 34·72 | 16·28 | 0·43 | 34·72 | 9·78 | 1·92 |
| April | 34·79 | 13·84 | 0·70 | 34·78 | 11·20 | 1·33 |
| May | 34·78 | 14·31 | 0·83 | 34·83 | 14·01 | 0·98 |
| June | 34·90 | 12·84 | 1·33 | 34·90 | 12·84 | 1·35 |
| July | 34·31 | 13·16 | 1·10 | 34·88 | 13·74 | 1·08 |
| August | 34·79 | 12·89 | 1·37 | 34·76 | 12·67 | 1·42 |
| September | 34·79 | 13·26 | 0·51 | 34·74 | 10·49 | 1·58 |
| October | 34·78 | 16·08 | 0·45 | 34·74 | 9·95 | 0·59 |
| November | 34·72 | 12·36 | 0·63 | 34·69 | 9·85 | 1·90 |
| December | 34·67 | 14·27 | 0·23 | 34·69 | 8·87 | 1·87 |

There is, therefore, a relationship between the bloom of phytoplankton organisms and the consumption of inorganic phosphate; the greatest consumption of phosphate clearly occurs in the 0 to 20 metre layer. It is also clear that the phosphate content is considerably higher during spring and summer when large-scale upwelling occurs (see Upwelling).

### (iii) Temperature.

0 *metres.*

The maximum (16·28°C.) and minimum (12·30° C.) temperatures were recorded during March and January, respectively. At station DA the maximum surface temperature was also recorded during March. There was a definite correlation between the temperature and phosphate curves for this depth; a drop in temperature was generally associated with an increase in the phosphate content.

As stated in the discussion of temperatures recorded at station DA (page 10), it is difficult to correlate a total phytoplankton bloom with surface temperatures, as the latter are dependent on many factors such as absorption of solar energy, prevailing winds, tidal influences, etc. It is, however, interesting to note that phytoplankton is very scarce during autumn when surface temperatures are relatively high (Table 3). During January when the minimum surface temperature (Table 3 and Figs. 6 and 7) were recorded, abundant quantities of phytoplankton were found. During January, February, June, August, September, October, November and December large quantities of phytoplankton occurred. The surface temperatures stood at *circa* 12·0°C. during four of these months. In September and December the surface temperatures were 13·26°C. and 14·27°C., respectively (Table 3). The temperature range at which large quantities of phytoplankton occurred, varied from approximately 12°C.–14°C. This was also the case at station DA.

25 *metres.*

The maximum (14·01°C.) and minimum (8·87°C.) temperatures were recorded in May and December, respectively. As in the case of station DA (Table 1) the temperatures at 25 metres at this station were also comparatively high during the autumn and winter seasons when the phosphate content is lower and the phytoplankton organisms very scarce. During the spring and summer seasons the temperatures are relatively low, the phosphate content higher (upwelling) and phytoplankton organisms abundant.

At 20 metres (the depth closest to 25 metres where temperature readings were made) phytoplankton was abundant during the following months: January, February, June, August, September, November and December. During these months the temperature ranged from 8·87°C. to 12·84°C. (Table 3).



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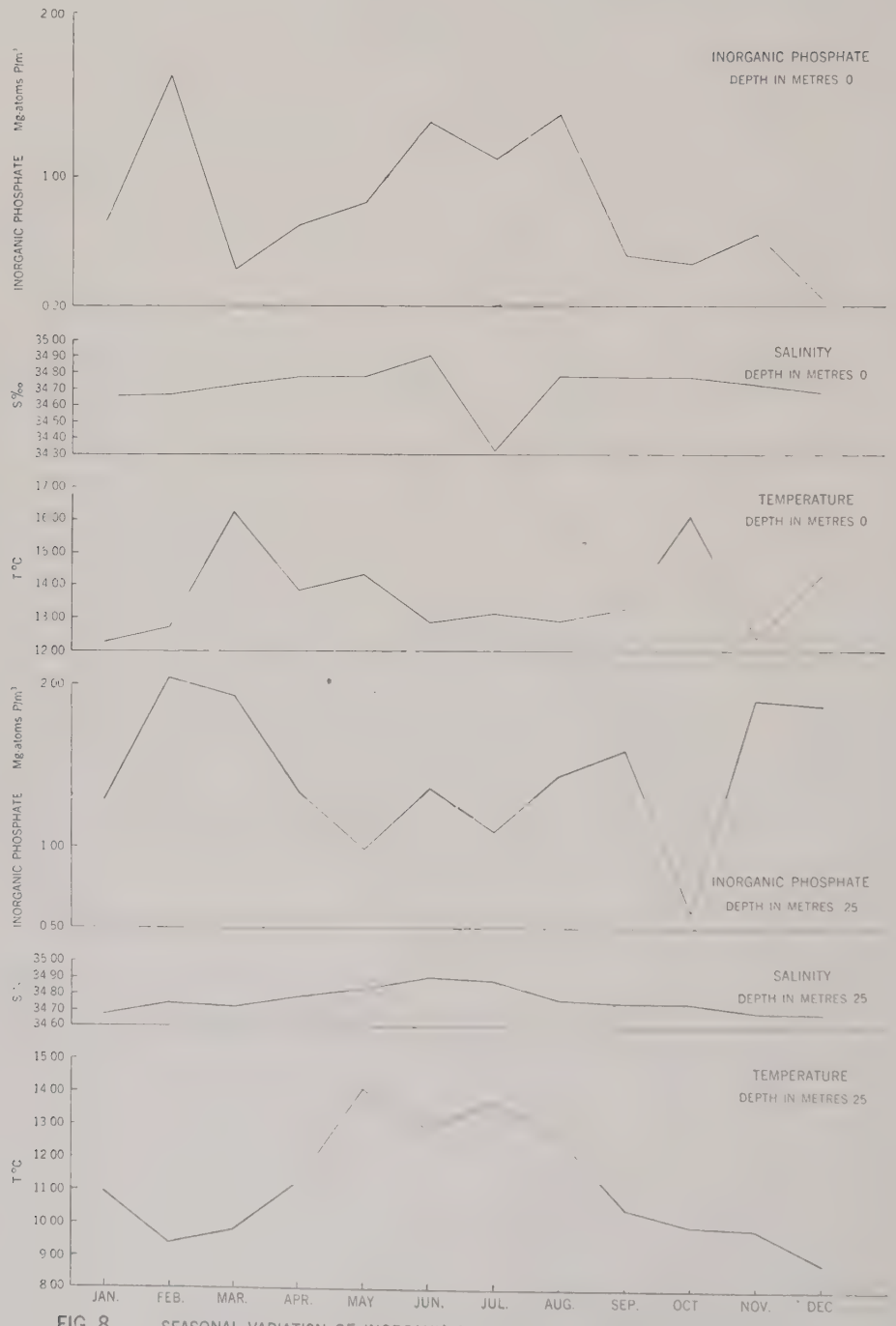


FIG. 8. SEASONAL VARIATION OF INORGANIC PHOSPHATE, SALINITY AND TEMPERATURE AT 0 AND 25 METRES, STATION DB, 1954.

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### (iv) Salinity.

0 *metres.*

On the whole the salinity remained constant during the year except during the month of July when a sharp decline was observed. The maximum ($34{\cdot}90^0/_{00}$) and minimum ($34{\cdot}31^0/_{00}$) were recorded during June and July, respectively.

As previously stated, the winter season of 1954 was characterized by a particularly heavy rainfall. The Berg River which flows into the southern part of St. Helena Bay could affect the salinity close to station DB to a greater extent than at station DA where the minimum was also recorded during July. The salinity at DB was lower than at station DA.

25 *metres.*

As in the case of the surface, the salinity at this depth was on the whole fairly constant. The maximum salinity ($34{\cdot}90^0/_{00}$) was recorded in June, while the minimum was recorded during January, November and December ($34{\cdot}69^0/_{00}$). The salinity curve shows a gradual and slight rise from autumn to winter and a gradual and slight decline from spring to summer.

On comparing the curves (25 metres) (Stations DA and DB) of total phytoplankton counts, phosphate contents, salinities and temperatures (seasonal basis) the following relationships are observed:—

(*a*) Phytoplankton is most abundant during the spring and summer seasons and scarce during autumn and winter.

(*b*) The phosphate content is relatively higher in spring and summer than in winter and autumn.

(*c*) Salinity is generally slightly higher during autumn and winter than during spring and summer.

(*d*) Temperature is relatively lower in spring and summer than in autumn and winter.

Phytoplankton is therefore most abundant during spring and summer when the phosphate content is relatively high and the temperature and salinity comparatively low; during the autumn and winter seasons phytoplankton is less abundant when the phosphate content is relatively low and the temperature and salinity high. The relationship between upwelling and all these factors are discussed under the chapter on " Upwelling " (see later).

### (v) The Depth Distribution of Phytoplankton Genera at Station DB—Quantitative Aspect.

The following genera were recorded in the counts at station DB during 1954: *Chaetoceros*, *Nitzschia*, *Thalassiosira*, *Skeletonema*, *Ceratium*, *Prorocentrum*, *Pleurosigma*, *Leptocylindrus*, *Dinophysis*, *Peridinium*, *Asterionella*, *Biddulphia*, *Thalassionema*, *Hemiaulus*, *Corethron*, *Rhizosolenia*, *Stephanopyxis*, *Licmophora* and *Navicula*.

The following are notes on the depth distribution and abundance of the genera concerned.

(*a*) *Chaetoceros.*

*January*, 1954.—The genus was distributed in the 0 to 30 metre layer. As in the case of station DA, the maximum number of cells/litre (2,077,500 cells) was recorded at 5 metres. Much larger numbers were recorded than at station DA. In the 0 to 20 metre layer *Chaetoceros* was one of the dominant genera while it was the dominant genus at 30 metres (Table 24). The temperatures at 0 and 25 metres were 12·30°C. and 10·96°C., respectively. The mean of the temperature at 0 and 25 metres (11·63°C.) was somewhat higher than that of Station DA.

*February*, 1954.—A sharp decline occurred in the numbers of *Chaetoceros* from January to February. This genus was distributed between 0 and 20 metres and the maximum number of cells/litre (70,000 cells) was again recorded at 5 metres. At 0 and 5 metres *Chaetoceros* was the dominant genus; at 10 and 20 metres it also constituted a large percentage of the catches (Tables 22 and 23). The temperatures at 0 and 25 metres were 12·77°C. and 9·35°C., respectively. At station DA no *Chaetoceros* was found during February.

*June*, 1954.—*Chaetoceros* was distributed in the 0 to 20 metre layer and the maximum number of cells/litre (40,000 cells), as in the case of January and February, was again recorded at 5 metres. *Chaetoceros* was one of the dominant genera in the catches and represented as much as 38 per cent of the catch made at 5 metres (Table 21). The temperature recorded at 0 and 25 metres was 12·84°C. in both cases.

*August*, 1954.—During this month the genus was distributed between 5 and 50 metres. The maximum number of cells/litre (82,500 cells) was recorded at 5 metres. *Chaetoceros* accounted for a considerable proportion of the catches made at 5 and 50 metres (Tables 21 and 25). The temperatures at 0 and 25 metres were 12·89°C. and 12·67°C., respectively.

TABLE 4.

STATION DB, 1954.

| 1954 | Total Number of Cells in the 0–20 Metre Layer*. | | | | | Average value of observations at 0–25 Metres. | | |
|---|---|---|---|---|---|---|---|---|
| | *Chaeto-ceros.* | *Nitz-schia.* | *Thalas-siosira.* | *Skele-tonema.* | *Ceratium.* | T°C. | P mg–atoms/m³. | S‰. |
| January | 3,287,500 | 4,430,000 | — | — | 50,000 | 11·63 | 1·00 | 34·69 |
| February | 130,000 | 22,500 | — | — | 72,500 | 11·06 | 1·82 | 34·70 |
| March | — | — | — | — | — | 13·03 | 1·17 | 34·72 |
| April | — | — | — | — | — | 12·52 | 1·01 | 34·79 |
| May | — | — | — | — | — | 14·16 | 0·90 | 34·80 |
| June | 110,000 | 75,000 | 120,000 | 57,500 | — | 12·84 | 1·34 | 34·90 |
| July | — | — | — | — | — | 13·45 | 1·09 | 34·59 |
| August | 105,000 | 22,500 | 342,500 | — | — | 12·28 | 1·39 | 34·77 |
| September | 1,125,500 | 632,500 | 1,165,000 | 15,000 | — | 11·87 | 1·04 | 34·76 |
| October | 245,000 | 757,500 | 80,000 | 3,972,500 | — | 13·01 | 0·52 | 34·76 |
| November | 1,917,500 | 20,000 | 230,000 | — | — | 11·10 | 1·26 | 34·70 |
| December | 3,165,000 | 237,500 | 115,000 | 700,000 | — | 11·57 | 1·05 | 34·68 |

* 1 Litre sample at each of the following depths: 0, 5, 10 and 20 metres.

*September*, 1954.—In September *Chaetoceros* was distributed in the 0 to 20 metre layer, the maximum number of cells litre (372,500 cells) being recorded at 5 metres. During this month *Chaetoceros* was more abundant at station DA than at station DB. This genus was dominant at 10 and 20 metres and constituted a large percentage of the catches made at other depths (Tables 22 and 23). The temperatures recorded at 0 and 25 metres were 13·26°C. and 10·49°C., respectively.

*October*, 1954.—Much smaller quantities of this genus were found than during September and it was distributed in the 0–10 metre layer. The maximum number of cells litre (145,000 cells) was recorded at 0 metres. Comparatively speaking *Chaetoceros* constituted but a small percentage of the catches during October (Table 20). Once again larger quantities were recorded than those recorded at station DA during October. The temperatures at 0 and 25 metres were 16·08°C. and 9·55°C., respectively.

*November*, 1954.—*Chaetoceros* was distributed between 0 and 30 metres and also occurred at 50 metres. The maximum numbers of cells litre was recorded at 5 metres. This genus was dominant in the catches and represented large percentages of the catches (Tables 20, 24, and 25). The temperatures recorded at 0 and 25 metres were 12·36°C. and 9·85°C., respectively.

*December*, 1954.—As in the case of station DA, *Chaetoceros* was distributed over the entire depth range (0–50 metres) at station DB during December, the maximum number of cells litre (1,220,000 cells) being recorded at 10 metres. As in November, *Chaetoceros* was also the dominant genus in December and constituted a very large percentage of the catches (Tables 20–25).

*Chaetoceròs* occurred at station DB during eight months of the year; at station DA this genus was recorded during six months of the year and the number of cells litre was generally lower than at station DB. During three months of the year (February, November and December) *Chaetoceros* was the dominant organism in the catches. During all the other months of occurrence this genus was invariably one of the principal genera in the catches, thus constituting a large percentage of the catches (Tables 20–25).

Table 4 clearly shows that the total number of cells litre between 0 and 20 metres exceeded the one million mark during January, September, November and December. During these months the average values of temperature, salinity and phosphate content of observations made at 0 and 25 metres, ranged from 11·10°C. – 11·87°C., 34·68‰–34·76‰ and 1·00–1·26 mg.-atoms P/m³, respectively. These values of the temperature, salinity and phosphate content (station DB) differ somewhat from those observed at station

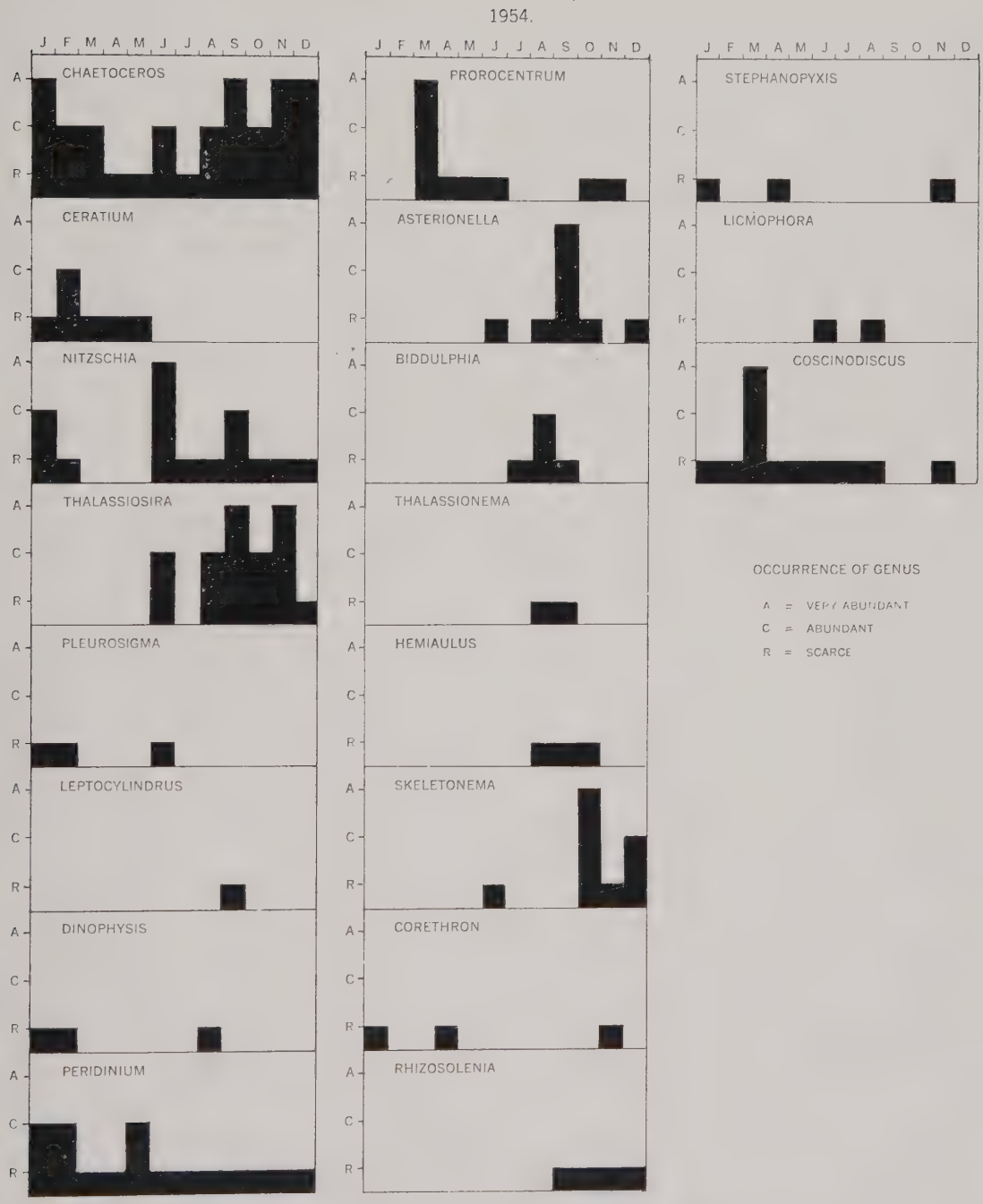


FIG. 9. SEASONAL OCCURRENCE OF PHYTOPLANKTON GENERA (ACCORDING TO N50V, 50-0 METRES) AT STATION DB, 1954

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DA; the temperature and salinity ranges are lower but the phosphate content is slightly higher (page 13). A considerable increase in the number of *Chaetoceros* therefore occurred in water with a relatively lower temperature and salinity and relatively high phosphate content. These conditions prevailed during the months of the spring and summer seasons and were produced by the process of upwelling and abundant sunshine. Smaller numbers of this genus occurred during February, June, August and October. During these months when a much smaller bloom occurred than during January, September, November and December (Table 3), the average values of temperature, salinity and phosphate content were as follows: Temperature 11·06°C. – 13·01°C., salinity 34·70‰–34·90‰ and phosphate content 0·52 mg.-atom P/m³–1·82 mg.-atom P/m³.

The maximum number of cells/litre of this genus was almost without exception recorded at 5 metres; only twice during the year was the maximum number of cells/litre recorded at 0 and 10 metres. As a result of the large volumes and the frequency of occurrence of *Chaetoceros* in the commercial fishing area, this genus constitutes the main food diatom in the plankton succession.

As net hauls give only an approximate indication of the quantitative abundance of a genus, the following symbols are used to indicate the estimated quantities (Fig. 9):—

A = occurrence of genus *very abundant*.
C = occurrence of genus *abundant*.
R = genus present but in *small numbers*.

In the phytoplankton catches (N50V, 50–0 metres) made at station DB, the seasonal variation of *Chaetoceros* was as follows:—

*Chaetoceros* occurred in the net catches during every month of the year (Fig. 9). During January, September, November and December this genus was *very abundant*. These data therefore correspond with those of the phytoplankton counts where the highest counts were also recorded during these months (Table 3). This genus was *abundant* in the net catches during February, March, June, August and October. With the exception of March, these data closely correspond with those in respect of the phytoplankton counts. During April and May *Chaetoceros* occurred in the net catches but only in small numbers. This important food diatom therefore occurred in the southern part of the fishing area during every month of the year. With the exception of February, this was also the case in the northern part of the fishing area (see under DA).

The analysis of the net catches and phytoplankton counts clearly revealed that *Chaetoceros* occurred in vast quantities during *spring* and *summer* and in much smaller quantities during the *winter season*, while the genus was very scarce during *autumn*.

(*b*) *Thalassiosira.*

*June*, 1954.—*Thalassiosira* was distributed between 0 and 20 metres, the maximum numbers (50,000 cells/litre) being recorded at 5 metres. These numbers are considerably smaller than those recorded at station DA during June. At 5 and 10 metres *Thalassiosira* was the dominant genus in the catches (Tables 21–22). The temperature at 0 and 25 metres was 12·84°C. in both instances.

*August*, 1954.—This genus was distributed between 0 and 50 metres; the maximum number of cells/litre (95,000 cells) was recorded at 5 metres. Good quantities of *Thalassiosira* were also recorded at 0, 10 and 20 metres. This genus was dominant in the caches made in the 0–30 metre layer (Tables 20–24). The temperatures recorded at 0 and 25 metres were 12·89°C. and 12·67°C., respectively.

*September*, 1954.—*Thalassiosira* was distributed in the 0–20 metre layer. The maximum number of cells/litre (435,000 cells) was recorded at 5 metres. The number of cells/litre was much higher than at station DA during September. *Thalassiosira* was the dominant genus at 0 and 5 metres and also constituted a large percentage of the catches made at other depths (Tables 20–21). The temperatures at 0 and 25 metres were 13·26°C. and 10·49°C., respectively.

*October*, 1954.—This genus was distributed in the 0–10 metre layer, the maximum number of cells/litre (40,000 cells) being found at 5 metres. Once again slightly larger numbers were recorded than at station DA. *Thalassiosira* represented only a small percentage of the catches made at all depths (Tables 20–22). The temperatures at 0 and 25 metres were 16·08°C. and 9·95°C., respectively.

*November*, 1954.—*Thalassiosira* was distributed between 0 and 20 metres; the maximum number of cells/litre (100,000 cells) was again recorded at 5 metres. Much larger numbers were recorded than at station DA. This genus constituted a large proportion of the catches at 20 metres only (Tables 20–23). The temperatures at 0 and 25 metres were 12·36°C. and 9·85°C., respectively.

*December*, 1954.—Relatively small numbers of this genus were recorded between 0 and 20 metres.

The maximum number of cells/litre (55,000 cells) was found at 0 metres. Once again larger quantities were found than in the case of station DA. During December this genus constituted but a small percentage of the catches (Tables 20–23). The temperatures at 0 and 25 metres were 14·27°C. and 8·87°C., respectively.

*Thalassiosira* occurred at station DB during six months of the year, viz., June, August, September, October, November and December. Five out of six times the maximum number of cells/litre was recorded at 5 metres and the genus was distributed mainly between 0 and 20 metres. Much larger volumes of *Thalassiosira* occurred at station DB than at station DA. From Table 4 it is clear that this genus was most abundant during spring, while considerable quantities occurred during two months of the winter and summer seasons, respectively. In autumn the genus was very scarce.

The heaviest bloom (totalling 1,165,000 cells in the 0–20 metre layer) was recorded during September when the average values of temperature, salinity and phosphate content of observations made at 0 and 25 metres were as follows: Temperature 11·87°C., salinity 34·76$^0/_{00}$ and phosphate content 1·04 mg.-atoms P/m$^3$. During the months when upwelling almost certainly occurred (see Upwelling) *Thalassiosira* never exceeded the one million mark (number of cells/litre). It appears, therefore, that this genus bloomed in water which had already been warmed after upwelling had occurred. This genus often appeared together with *Chaetoceros*, but the latter genus increased considerably in numbers during the months of intensive upwelling. *Thalassiosira* was the dominant genus in the catches made during June, August and September. (At station DA this genus was dominant in the catches during June only). During August *Thalassiosira* was distributed over the entire depth range (0–50 metres).

In the net catches (N50V) this genus occurred during the months of June, August, September, October, November and December. During September and November *Thalassiosira* was *very abundant* and in June, August and October it was *abundant*. During November the genus was recorded but in *small numbers*.

Although *Thalassiosira* did not occur in such large volumes at station DB as *Chaetoceros*, the frequency of occurrence and quantities of this genus indicate that it also constitutes one of the main food diatoms of the commercial fishing area of St. Helena Bay.

(*c*) *Nitzschia.*

*January*, 1954.—Large quantities of this genus were distributed in the 0–30 metre layer during this month. The maximum number of cells/litre (2,097,500 cells) was recorded at 5 metres after which a gradual decrease in numbers was observed as greater depths were reached. *Nitzschia* was much more abundant at station DB during January than at station DA. *Nitzschia* greatly outnumbered the other genera in the 0–20 metre layer. A considerable percentage of this genus was also found at 30 metres (Tables 20–24). The temperatures at 0 and 25 metres were 12·30°C. and 10·96°C., respectively.

*February*, 1954. — Much smaller quantities occurred during February than during January. *Nitzschia* was distributed in the 0–10 metre layer and the maximum number of cells/litre (17,500 cells) was recorded at 0 metres where this genus constituted a considerable percentage of the catch (Tables 20–22). The temperatures at 0 and 25 metres were 12·77°C. and 9·35°C., respectively.

*June*, 1954.—*Nitzschia* was unevenly distributed between 0 and 20 metres and the maximum number of cells/litre (52,500 cells) was recorded at 0 metres. Much smaller numbers were found during June than at station DA. This genus was dominant in the catch made at 0 metres only (Tables 20–23). The temperature recorded at 0 and 25 metres was 12·84°C. in both cases.

*August*, 1954.—Small quantities of this genus were recorded only at 0, 5 and 30 metres. The maximum number of cells/litre (15,000 cells) was found at 5 metres. *Nitzschia* constituted a relatively small percentage of the catches (Tables 20, 21 and 24). The temperatures at 0 and 25 metres were 12·89°C. and 12·67°C., respectively.

*September*, 1954.—Vast quantities of *Nitzschia* occurred in the 0–20 metre layer during this month. The maximum number of cells/litre (215,000 cells) was recorded at 5 metres. *Nitzschia* accounted for a moderate percentage of the catches (Tables 20–23). The temperatures at 0 and 25 metres were 13·26°C. and 10·49°C., respectively.

*October*, 1954.—During this month the genus was distributed in the 0 to 10 metre layer, the maximum number of cells/litre (377,500 cells) being recorded at 0 metres. Considerably larger volumes were recorded than those found at station DA during October. *Nitzschia* constituted a large proportion of the catches (Tables 20–22). The temperatures at 0 and 25 metres were 16·08°C. and 9·95°C., respectively.

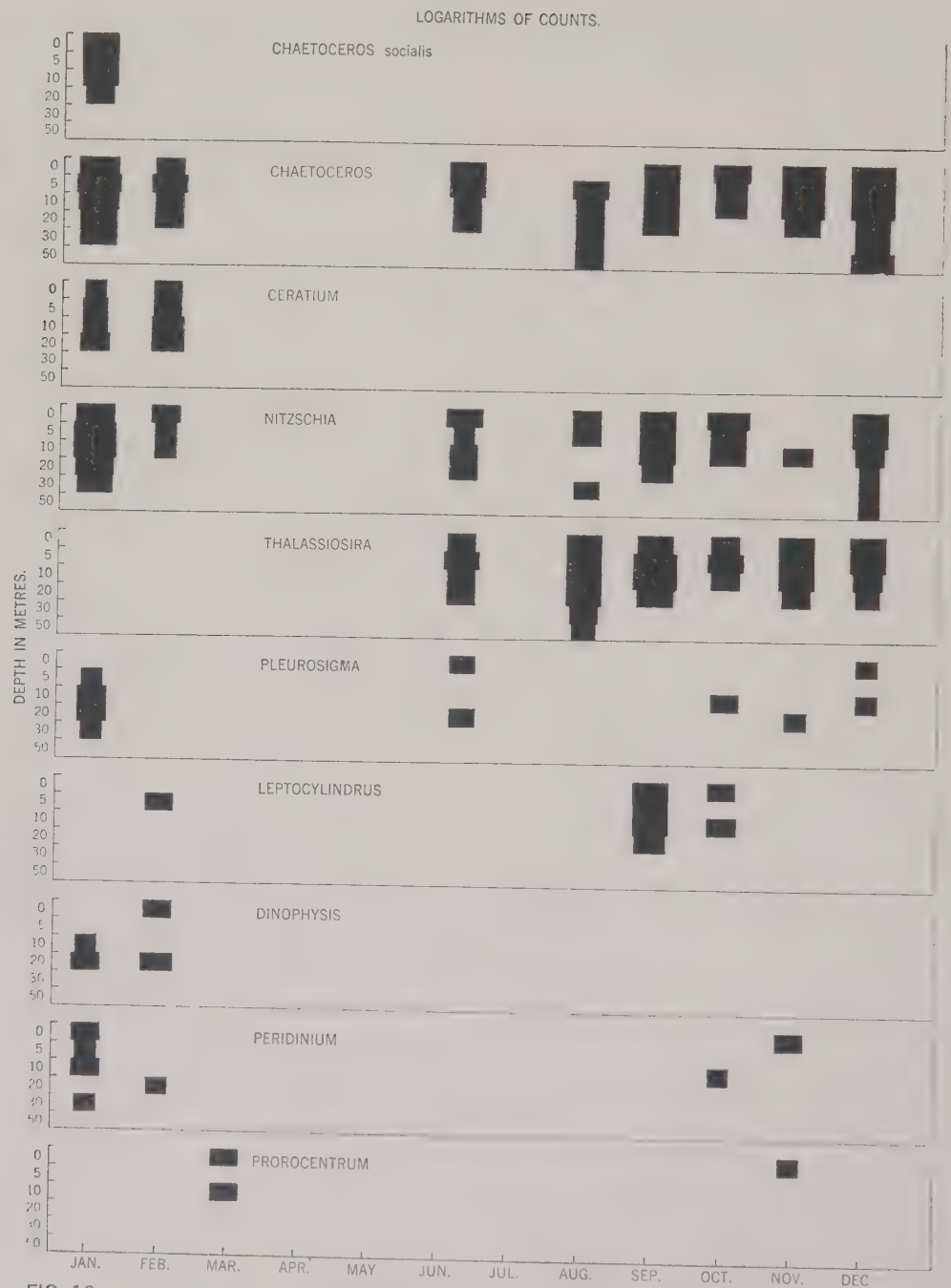


FIG. 10. SEASONAL AND DEPTH DISTRIBUTION OF PHYTOPLANKTON AT STATION DB, 1954.

Trigsurvey. 1956 (LOGARITHMS OF COUNTS.)

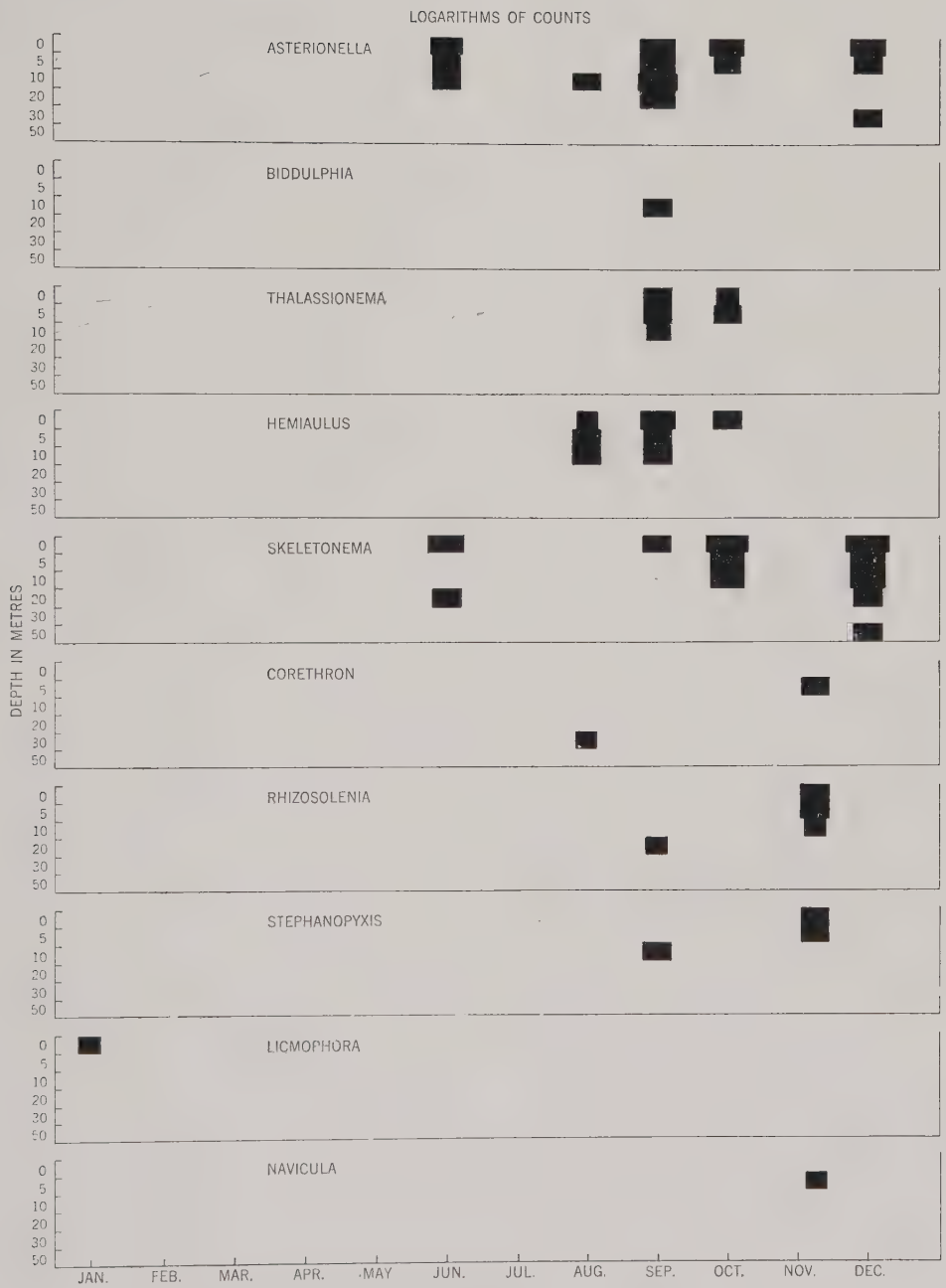


FIG. 11 SEASONAL AND DEPTH DISTRIBUTION OF PHYTOPLANKTON AT STATION DB, 1954.

(LOGARITHMS OF COUNTS.)

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*November*, 1954.—During November this genus was recorded only at 20 metres (20,000 cells/litre). Despite the fact that this genus was found only at 20 metres, the numbers were still higher than those recorded at station DA at 0, 5 and 20 metres. *Nitzschia* accounted for a small percentage of the catch (Table 23). The temperatures at 0 and 25 metres were 12·36°C. and 9·85°C., respectively.

*December*, 1954.—During this month *Nitzschia* was distributed over the entire depth range (0–50 metres). The maximum number of cells/litre (130,000 cells) was recorded at 0 metres. There was a decrease in numbers from the surface downwards; i.e., at 20, 30 and 50 metres only minimal quantities were found. The number of cells/litre was once again considerably higher than at station DA. *Nitzschia* constituted but a small percentage of the catches made during December (Tables 20–25). The temperatures at 0 and 25 metres were 14·27°C. and 8·87°C., respectively.

*Nitzschia* occurred at station DB during eight months of the year, namely January, February, June, August, September, October, November and December. The distribution of the genus was mainly between 0 and 20 metres; during January and December the genus occurred over the entire depth range (0–50 metres). On the whole, the number of cells/litre decreased as greater depths were reached. The heaviest *Nitzschia* bloom was recorded during January when the total number of cells in the 0–20 metre layer (Table 4) was 4,430,000. During that month the average values of temperature, salinity and phosphate content based on observations made at 0 and 25 metres were as follows: temperature 11·63°C., salinity 34·69‰ and phosphate content 1·00 mg.-atoms P/m$^3$. The temperature and salinity were therefore relatively low, and the phosphate content relatively high during this month in which upwelling occurred. During the other months of occurrence of *Nitzschia* the total number of cells of this genus in the 0–20 metre layer never exceeded the one million mark. This genus occurred during all three months of the summer and spring seasons. During two months of the winter season *Nitzschia* was present, but during autumn it was very scarce. The heaviest bloom of this genus, therefore, occurred during the spring and summer seasons when upwelling occurred (see Upwelling). During winter when no marked upwelling was observed at station DB, relatively small quantities of this genus occurred.

*Nitzschia* was more abundant at station DB than at station DA. At station DA the maximum bloom of this genus was recorded during September when the temperature and salinity were relatively high. As mentioned previously the maximum *Nitzschia* bloom was recorded at station DB during January when the temperature and salinity were relatively low. At station DA this genus never occurred at depths of more than 30 metres; at station DB this genus was distributed over the entire depth range (0–50 metres) during two months of the year. This genus occurred in considerable quantities together with *Chaetoceros*.

In the net catches (N50V) *Nitzschia* was recorded nine times in the course of the year. The genus was *very abundant* in the net catches only during June, and *abundant* during January and September. During February, July, August, October, November and December this genus was scarce. No marked correspondence between the counts and the net catches was observed in respect of *Nitzschia*. This genus is a very small organism, however, and large numbers may possibly have excaped through the nets.

In view of the large volumes of *Nitzschia* recorded as well as the frequency of occurrence of this genus, it is clear that it was also one of the main food diatoms in the plankton succession at station DB.

(*d*) *Skeletonema*.

*June*, 1954.—This genus was recorded only at 0 and 20 metres. The maximum number of cells/litre (35,000 cells) was found at 0 metres. At this depth *Skeletonema* represented 18·7 per cent of the catch, while it was the dominant genus at 20 metres (Table 23). The temperature recorded at 0 and 25 metres was 12·84°C. in both cases.

*September*, 1954.—*Skeletonema* was recorded only in the 0 metre layer (15,000 cells/litre) during September and formed but an insignificant percentage of the catch made at this depth (Table 20). The temperatures at 0 and 25 metres were 13·26°C. and 10·49°C., respectively.

*October*, 1954.—This genus was distributed in the 0–10 metre layer during this month, the maximum number of cells/litre (2,445,000 cells) being recorded at 0 metres. These numbers were much higher than those recorded at station DA where this genus occurred only during October.

*Skeletonema* was the dominant genus in the catches made at all depths where phytoplankton occurred at station DB during October. At 0 metres this genus constituted 80 per cent of the catch (Table 20). The temperatures at 0 and 25 metres were 16·08°C. and 9·95°C., respectively. A heavy *Skeletonema* bloom therefore occurred

when the surface temperature was relatively high (the maximum number of cells/litre was recorded at the surface).

*December*, 1954.—The genus occurred at 0, 5, 10 20 and 50 metres and the maximum number of cells/litre (470,000 cells) was recorded at 0 metres. At 0 and 5 metres *Skeletonema* accounted for a considerable percentage of the catches (Tables 20 and 21). The temperatures at 0 and 25 metres were 14·27°C. and 8·87°C., respectively. During December the surface temperature was also relatively high and the maximum number of cells/litre was again recorded at 0 metres.

*Skeletonema* therefore occurred at station DB during four months of the year; at station DA, on the other hand, this genus was recorded only during October when the maximum bloom occurred at station DB. It is possible, therefore, that this genus had a very wide distribution in the St. Helena Bay area during October. During that month *Skeletonema* was the dominant genus in the catches, while it also constituted a considerable percentage of the catches made during June and December. The maximum number of cells/litre was invariably recorded at the surface; the largest quantities of *Skeletonema* were therefore recorded at relatively high surface temperatures.

In the net catches (N50V) *Skeletonema* was *very abundant* during October while *abundant* quantities were recorded during December. The genus was found during June and November but only in *small quantities*. The occurrence of this genus as reflected in the net catches corresponds with the counts.

*Skeletonema* also forms an important food diatom in the plankton succession of the southern part of the commercial fishing area of St. Helena Bay.

(*e*) *Ceratium*.

*January*, 1954.—This genus was distributed between 0 and 20 metres; the maximum number of cells/litre (22,500 cells) was recorded at 20 metres. The numbers increased as the depth increased. Smaller quantities were recorded than at station DA. *Ceratium* constituted only a small percentage of the catches made during this month (Tables 20–23). The temperatures at 0 and 25 metres were 12·30°C. and 10·96°C., respectively.

*February*, 1954.—*Ceratium* was distributed between 0 and 20 metres and the maximum number of cells/litre (22,500 cells) was recorded at 10 and 20 metres. As during January, the number of cells/litre increased as the depth increased. *Ceratium* constituted a much larger proportion of the catches than during January; at 10 metres *Ceratium* was the dominant genus (Table 22). This genus did not constitute a greater percentage of the catches during February as a result of an increase in the number of cells/litre, but because much fewer genera were recorded in smaller quantities during February. Much smaller quantities of *Chaetoceros* and *Nitzschia* occurred during this month than during January (Table 4). The total number of cells of *Ceratium* in the 0–20 metre layer was only slightly higher in February than in January.

*Ceratium* therefore occurred at station DB during only two months of the year. During these months (January and February) the temperature and salinity were relatively low and the phosphate content relatively high (Table 4). Upwelling also took place during these months.

In the net catches (N50V) this genus was *abundant* during February; during January, March, April and May *Ceratium* occurred in the catches, but only in *small numbers*.

(*f*) *Prorocentrum*.

*March*, 1954.—Small quantities (5,000 cells/litre) of *Prorocentrum* were distributed in the 0–10 metre layer. At station DA the numbers were considerably higher and *Prorocentrum* was the dominant genus. The temperatures at 0 and 25 metres were 16·28°C. and 9·78°C., respectively.

*November*, 1954.—During this month *Prorocentrum* was recorded in insignificant quantities (2,500 cells/litre) at 5 metres and therefore constituted a very small percentage of the catch made at this depth.

*Prorocentrum* was observed in the counts during these two months of the year only (March and November) and in minimal quantities. During March this genus had a wide distribution in the St. Helena Bay area (page 19) where reference is made to the occurrence of " red water ".

In the net catches (N50V) *Prorocentrum* was *very abundant* during March; during April, May, June, October and November this genus was present but only in *small numbers*.

(*g*) *Pleurosigma*.

*January*, 1954.—This genus was distributed between 0 and 30 metres; the maximum number of cells/litre (15,000 cells) was recorded at 20 metres. Somewhat larger volumes were recorded than at station DA. *Pleurosigma* constituted a

very small percentage of the catches (Tables 20–24). The temperatures at 0 and 25 metres were 12·30°C. and 10·96°C., respectively.

*June*, 1954.—Very small numbers (7,500 cells/litre) of *Pleurosigma* were recorded at 0 and 20 metres. At 20 metres this genus represented 9 per cent of the catch (Table 23). Slightly larger quantities were recorded than at station DA. The temperature at 0 and 25 metres was 12·84°C. in both cases.

*October*, 1954.—This genus occurred only in small numbers (5,000 cells/litre) at 10 metres and therefore constituted a very small proportion of the catch made at this depth. The temperatures at 0 and 25 metres were 16·08°C. and 9·95°C., respectively.

*November*, 1954.—Very small numbers (2,500 cells/litre) of *Pleurosigma* were recorded at 20 metres and the genus constituted only 2 per cent of the catch (Table 23). The temperatures at 0 and 25 metres were 12·36°C. and 9·85°C., respectively.

*December*, 1954.—This genus was recorded at two depths (0 and 5 metres) during December. Once again the numbers were small and *Pleurosigma* accounted for but a small percentage of the catches. The temperatures at 0 and 25 metres were 14·27°C. and 8·87°C., respectively.

Although *Pleurosigma* occurred at station DB during five months of the year, the numbers, as in the case of station DA, were never high. During January when the maximum number of cells/litre (15,000 cells) was recorded, the temperature and salinity were relatively low and the phosphate content relatively high (Table 4).

In the net catches (N50V) *Pleurosigma* occurred in *small numbers* during January, February and June.

(*h*) *Leptocylindrus.*

*February*, 1954.—Small quantities (7,500 cells/litre) of *Leptocylindrus* were recorded at 5 metres; the genus represented 7 per cent of the catch made at this depth. Phytoplankton was, however, on the whole scarce during February. The temperatures at 0 and 25 metres were 12·77°C. and 9·35°C., respectively.

*September*, 1954.—During this month *Leptocylindrus* was distributed between 0 and 20 metres. Considerably larger numbers were recorded than during February. The maximum number of cells/litre (137,500 cells) was found at 5 metres. The genus constituted a fairly high percentage of the catches (Tables 20–23). The temperatures at 0 and 25 metres were 13·26°C. and 10·49°C., respectively.

*October*, 1954.—During October this genus occurred only at 0 and 10 metres. The maximum number of cells/litre (10,000 cells) was recorded at 0 metres. *Leptocylindrus* constituted a very small percentage of the catches (Tables 20–22). The temperatures at 0 and 25 metres were 16·08°C. and 9·95°C., respectively.

*Leptocylindrus* was therefore recorded at station DB during three months of the year. The largest quantities of this genus occurred during September when the average temperature between 0 and 25 metres was 11·87°C. The maximum number of cells/litre was always recorded at the surface. At station DA this genus also occurred in good quantities during September and *Leptocylindrus* therefore probably had a wide distribution in St. Helena Bay.

In the net catches (N50V) *Leptocylindrus* occurred in small numbers only during September.

(*i*) *Dinophysis.*

*January*, 1954.—Only small volumes of this genus were found at 10 and 20 metres. The maximum number of cells/litre (only 7,500 cells) was recorded at 20 metres. *Dinophysis* constituted an insignificant proportion of the catches (Tables 22 and 23). The temperatures at 0 and 25 metres were 12·30°C. and 10·96°C., respectively.

*February*, 1954.—*Dinophysis* was found at 5 and 20 metres; numbers were much higher than during January and the maximum number of cells/litre (30,000 cells) was recorded at 20 metres where *Dinophysis* was the dominant genus (Tables 21 and 23). The temperatures recorded at 0 and 25 metres were 12·77°C. and 9·35°C., respectively.

This genus occurred at station DB during two months of the year only; at station DA the genus occurred only during January in very small numbers. In the net catches (N50V) *Dinophysis* occurred in very small quantities during January, February and August.

(*j*) *Peridinium.*

*January*, 1954.—Small numbers of *Peridinium* were distributed between 0 and 10 metres and also occurred at 30 metres. The maximum number of cells/litre (only 5,000 cells) was recorded at 0 and 10 metres. This genus constituted a very small percentage of the catches made during January (Tables 20–22). The temperatures at 0 and 25 metres were 12·30°C. and 10·96°C., respectively.

*February*, 1954.—Minimal quantities of *Peridinium* (2,500 cells/litre) were found at 20 metres, and consequently formed an insignificant percentage of the catch made at this depth (Table 23).

The temperatures at 0 and 25 metres were 12·77°C. and 9·35°C., respectively.

*October*, 1954.—This genus was again recorded only in small quantities (2,500 cells/litre) at 10 metres and represented a small percentage of the catch. The temperatures at 0 and 25 metres were 16·08°C. and 9·95°C., respectively.

*November*, 1954.—Only 5,000 cells/litre of this genus were found at 0 metres. During November *Peridinium* again accounted for but a very small proportion of the catches. The temperatures at 0 and 25 metres were 12·36°C. and 9·85°C., respectively. During November considerably higher quantities of this genus were recorded at station DA.

Although *Peridinium* occurred at station DB during four months of the year, this genus constituted but an insignificant percentage of the total phytoplankton catches. The genus was distributed mainly in the 0–10 metre layer.

In the net catches (N50V) *Peridinium* occurred during every month of the year; during January, February and May it was *abundant* and during the remaining months it occurred in *small quantities*. In the net catches made at station DA this genus also occurred throughout the year except during June and October. It appears, therefore, that *Peridinium* had a wide distribution and a high frequency of occurrence in the St. Helena Bay area, although the numbers were generally small except during November when large volumes of this genus were recorded at station DA.

(*k*) *Asterionella*.

*June*, 1954.—*Asterionella* was distributed in the 0–10 metre layer and the maximum number of cells/litre (27,500 cells) was recorded at 0 metres. This genus constituted a considerable percentage of the catches (Table 20). The temperature at 0 as well as at 25 metres was 12·84°C.

*August*, 1954.—This genus was found only at 20 metres (15,000 cells/litre) and at that depth *Asterionella* represented 14 per cent of the catch (Table 23). The temperatures at 0 and 25 metres were 12·89°C. and 12·67°C., respectively.

*September*, 1954.—*Asterionella* was distributed between 0 and 20 metres, the maximum number of cells/litre (312,500 cells) being recorded at 10 metres. At station DA this genus occurred only during September and in much smaller numbers than at station DB. It formed a considerable proportion of the catches (Tables 20 and 23). The temperatures recorded at 0 and 25 metres were 13·26°C. and 10·49°C., respectively.

*October*, 1954.—The numbers of this genus were much lower than during the previous month. It was recorded only at 0 and 5 metres; the maximum number of cells/litre (35,000 cells) was recorded at 0 metres. This genus constituted only a small percentage of the catches made at these depths (Tables 20–21). The temperatures at 0 and 25 metres were 16·08°C. and 9·95°C., respectively.

*December*, 1954.—*Asterionella* was found at 0 and 5 metres only, the maximum number of cells/litre (45,000 cells) being recorded at 0 metres. The genus therefore constituted only a minimal percentage of the catches. The temperatures at 0 and 25 metres were 14·27°C. and 8·87°C., respectively.

*Asterionella* therefore occurred at station DB during five months of the year; at station DA this genus was recorded only during September. The genus therefore probably had a wide distribution during September. During that month when the highest total number of cells occurred in the 0–20 metre layer (590,000 cells), the average temperature between 0 and 25 metres was 11·87°C., the salinity $34{\cdot}76^{0}/_{00}$ and the phosphate content 1·04 mg.-atoms $P/m^3$.

In the net catches (N50V) *Asterionella* was *very abundant* during September, but occurred only in *small quantities* during June, August, October and December. Observations of counts and net catches show a good correspondence.

(*l*) *Biddulphia*.

This genus occurred only during September (only at 20 metres) and in small numbers (5,000 cells/litre). It constituted an insignificant proportion of the catches made during this month (Table 23). The temperatures at 0 and 25 metres were 13·26°C. and 10·49°C., respectively. At station DA this genus was also recorded only during September, but in somewhat larger quantities than those at station DB.

In the net catches (N50V) *Biddulphia* was *abundant* during August and occurred in *small numbers* during July and September.

(*m*) *Thalassionema*.

*Thalassionema* was recorded at this station only during September and was distributed in the 0–10 metre layer. The maximum number of cells/litre

(15,000 cells) was recorded at 0 and 5 metres. The genus accounted for only a small percentage of the catches (Tables 20–22). The temperatures at 0 and 25 metres were 13·26°C. and 10·49°C., respectively. At station DA *Thalassionema* also occurred only during September; the distribution was again in the 0 to 10 metre layer and the number of cells/litre was slightly lower than at station DB.

In the net catches (N50V) this genus occurred in small quantities during August and September.

(*n*) *Hemiaulus.*

*August*, 1954.—This genus was distributed in the 0–10 metre layer, the maximum number of cells/litre (only 7,500 cells) being found at 10 metres. At 10 metres *Hemiaulus* constituted 7 per cent of the catch and at the other depths the percentage was small (Table 20). The temperatures at 0 and 25 metres were 12·89°C. and 12·67°C., respectively.

*September*, 1954—During this month the genus was distributed between 5 and 20 metres. The maximum number of cells/litre (37,500 cells) was recorded at 5 metres. Considerably higher quantities were therefore recorded than during the previous month. *Hemiaulus* never exceeded 2·8 per cent of the catches made during September (Tables 21 and 23). The temperatures at 0 and 25 metres were 13·26°C. and 10·49°C., respectively. At station DA *Hemiaulus* was recorded only during September and larger quantities were found than at station DB.

*October*, 1954.—This genus occurred only at 0 metres and the numbers were not high (15,000 cells/litre). The genus therefore represented a small percentage of the catch made at this depth (Table 20). The temperatures recorded at 0 and 25 metres were 16·08°C. and 9·95°C., respectively.

*Hemiaulus* occurred in small quantities in the net catches (N50V) during August, September and October, i.e. this genus was present in the nets from mid-winter to early spring.

(*o*) *Corethron.*

This genus was recorded during two months of the year only and in very small quantities. During August only 2,500 cells/litre were recorded at 30 metres and during November 5,000 cells/litre were found at 5 metres. *Corethron* therefore constituted minimal percentages of the catches made during those months (Tables 21 and 24).

In the net catches (N50V) small quantities of *Corethron* occurred during January, April and November.

(*p*) *Rhizosolenia.*

*September*, 1954.—This genus occurred in very small numbers (2,500 cells/litre) at 20 metres and formed a very small percentage of the catch (Table 23). The temperatures at 0 and 25 metres were 13·26°C. and 10·49°C., respectively.

*November*, 1954.—During this month *Rhizosolenia* was distributed in the 0–10 metre layer, the maximum number of cells/litre (17,500 cells) being found at 0 metres. This genus constituted only a small percentage of the catches made at these depths (Tables 20 and 22). The temperatures at 0 and 25 metres were 12·36°C. and 9·85°C., respectively. *Rhizosolenia* therefore occurred in the counts during two months of the year only; good quantities were recorded only during November. At station DA this genus was also recorded during November only and in very small numbers. This genus may possibly have had a wide distribution during November.

In the net catches (N50V) small quantities of *Rhizosolenia* occurred during September, October, November and December.

(*q*) *Stephanopyxis.*

This genus occurred in the counts only during September and November. During September only 10,000 cells/litre were recorded at 10 metres; during November 5,000 cells/litre were noted in the surface layer and 10,000 cells/litre at 10 metres. During both months *Stephanopyxis* constituted a very small percentage of the catches (Table 22).

Small numbers of *Stephanopyxis* were present in the net catches (N50V) during January, April and November.

(*r*) *Licmophora.*

This genus occurred only during January and in very small numbers (2,500 cells/litre) at 0 metres.

During June and August *Licmophora* was found in small numbers in the net catches (N50V).

(*s*) *Navicula.*

*Navicula* was found only during November in small quantities (2,500 cells/litre) at 5 metres. This genus never appeared in the net catches (N50V).

(*t*) *Coscinodiscus.*

The genus *Coscinodiscus* was never observed in the counts but occurred in the net catches (N50V) during most months of the year; only during September, October and November was it absent

from the net catches. The numbers recorded were invariably small, except during March when this genus was *very abundant* in the net catches. This genus was also *abundant* in the net catches made at station DA during March; *Coscinodiscus* was therefore probably widely distributed over the St. Helena Bay area during March.

*Coscinodiscus* had a high frequency of occurrence in the net catches but was never observed in the counts made at this station. In the discussion of this genus under station DA this disparity was pointed out. A large volume of water is filtered through the nets (50–0 metres), compared with the small water samples taken with the aid of the Nansen–Pettersson water bottle. This may be the reason for the absence of this genus from the counts. This opinion is also held by Dr. T. J. Hart of the National Institute of Oceanography (personal communication).

Although only small volumes of *Coscinodiscus* occurred in the net catches, it nevertheless constitutes an important food diatom in the plankton succession (when it occurs in abundant quantities) as this organism is relatively large in size compared with other organisms.

(*u*) *Chaetoceros socialis*.

This genus occurred in the counts only during January and was distributed in the 0–20 metre layer. The maximum number of cells/litre (152,500 cells) was recorded at 10 metres. *Chaetoceros socialis* represented up to 8 per cent of the catches made during this month (Table 22). The temperatures at 0 and 25 metres were 12·30°C. and 10·96°C., respectively.

Smaller quantities of *Chaetoceros socialis* were recorded at station DA, also only during January. It may therefore reasonably be assumed that this genus had a fairly wide distribution in the commercial fishing area of St. Helena Bay during January.

### (vi) Discussion.

At station DB considerable phytoplankton volumes occurred during nine months of the year. During all three months of the spring season (September, October and November) and the summer season (December, January and February) good quantities of phytoplankton were recorded. During two months of the winter season (June and August) it occurred in smaller quantities than during spring and summer. It was scarce during autumn and occurred only in small quantities during March. Phytoplankton was therefore *very abundant* during spring and summer, *less abundant* during winter and *scarce* during autumn. These seasonal variations correspond with those observed in respect of station DA; on the whole phytoplankton was, however, more abundant at station DB than at DA. In this connection it is interesting to note that pilchards, which feed mainly on plant organisms, are mostly caught in the southern part of the commercial fishing area of St. Helena Bay (Station DB is situated in the southern part of the Bay).

The south-easterly winds blowing mainly during the spring and summer seasons, increase upwelling so that more nutrient salts become available thus stimulating the growth of phytoplankton during these seasons. Another physical factor which affects the growth of phytoplankton organisms during spring and summer is the abundant sunshine.

As in the case of station DA, these favourable environmental factors also stimulated the growth of numerous phytoplankton genera at station DB. Of these genera, referred to on page 27, the following were dominant in the counts one or more times in the course of the year: *Chaetoceros*, *Nitzschia*, *Thalassiosira*, *Skeletonema* and *Ceratium*.

Large volumes of phytoplankton therefore occurred at stations DA and DB during the year. Although phytoplankton was scarcer during some seasons than during others, the counts and net catches clearly revealed that it was present in the commercial fishing area during every month of the year. The large shoals of fish occurring in this area were therefore provided with an adequate supply of food.

## 6. WINDS AND UPWELLING.

The Benguela current flowing in a north-westerly direction along the west coast of the Union has a high content of nutrient salts. Prevailing south-easterly winds on the West Coast result in increased upwelling. As the coast is on the righthand side of the direction of the Benguela current, upwelling produces colder and heavier water near the coast, provided that no current flows near the coast in opposition to the Benguela current. This cold and nutrient-rich upwelled water is ideal for the florescence of phytoplankton organisms provided that other physical conditions (such as sunlight) are favourable.

In order to assess the extent of upwelling in the commercial fishing area, observations (50–0 metres) made at stations L, M, N, O, Q, DA and DB were used (Table 5). According to these figures, it is apparent that upwelling occurred during January, February, March, April, November and December. During these months temperatures and salinities were relatively low, while the inorganic phosphate content was relatively high. During September and October there were indications that upwelling had taken place—temperatures were lower but the salinities were no lower than average. Strong south-easterly winds (observations made on board R.S. *Africana II*) blew in the research area during January, February, October and November. Daily observations made over a period of 10 years by the Weather Bureau (Davies, 1956) show that more than 50 per cent of all winds blowing during the following months, were southerly and easterly winds: January, February, March, April, September, October, November and December. During January, February, November and December the highest percentages of winds were from a south-easterly direction. (For full particulars see Table 14, Davies, 1956). These data on winds together with observations made by R.S. *Africana II* show that strong south-easterly winds blew during the spring and summer seasons, but that during late autumn and winter fewer south-easterly winds blew. South-easterly winds cause increased upwelling during spring and summer when temperatures and salinities consequently become relatively lower and the phosphate content relatively higher. Phytoplankton organisms reach a period of florescence during spring and summer when more nutrient salts become available as a result of increased upwelling; spring and summer are also associated with abundant sunlight. South-easterly winds therefore indirectly affect the growth of phytoplankton. During autumn and winter when these winds seldom occur, phytoplankton is much scarcer.

The environmental factors in the commercial fishing area are therefore particularly favourable for the growth and increase of phytoplankton which in turn permits the growth and increase of the zooplankton. The presence of large volumes of plankton in the area is favourable for the large shoals of pilchards and maasbankers found there.

TABLE 5.

AVERAGE INTEGRAL VALUES. 50–0 METRES (STATIONS L, M, N, O, Q, DA AND DB).

| 1954. | T°C. | Deviation from Average. | S°/₀₀. | Deviation from Average. | P. mg-atoms/m³. | Deviation from Average. |
|---|---|---|---|---|---|---|
| January | 10·52 | —1·07 | 34·70 | —0·09 | 1·62 | +0·20 |
| February | 10·72 | —0·87 | 34·73 | —0·06 | 1·72 | +0·30 |
| March | 11·19 | —0·40 | 34·75 | —0·04 | 1·68 | +0·26 |
| April | 11·43 | —0·16 | 34·78 | —0·01 | 1·54 | +0·12 |
| May | 13·27 | +1·68 | 34·80 | +0·01 | 1·25 | —0·17 |
| June | 12·77 | +1·18 | 34·85 | +0·06 | 1·30 | —0·12 |
| July | 13·08 | +1·49 | 34·93 | +0·14 | 1·18 | —0·24 |
| August | 12·78 | +1·19 | 34·99 | +0·20 | 1·22 | —0·20 |
| September | 11·57 | —0·02 | 34·85 | +0·06 | 1·35 | —0·07 |
| October | 11·02 | —0·57 | 34·79 | ±0·00 | 1·29 | —0·13 |
| November | 10·11 | —1·48 | 34·69 | —0·10 | 1·60 | +0·18 |
| December | 10 66 | —0·93 | 34·69 | —0·10 | 1·32 | —0·10 |
| AVERAGES | 11·59 | — | 34·79 | — | 1·42 | — |

## 7. THE OCCURRENCE AND DISTRIBUTION OF PHYTOPLANKTON IN THE COMMERCIAL FISHING AREA OF ST. HELENA BAY (STOMPNEUS–LAMBERT'S BAY).

Plankton tow-net hauls (N50V) were made at the following stations once a month: L, M, N, O, Q, JJ, NN and PP (Fig. 1). These stations are situated so that observations made at them cover the entire fishing area of St. Helena Bay. As data obtained from net hauls are not strictly quantitative, these data are only used to indicate the seasonal accurrence and distribution of phytoplankton oenera. Only genera which occurred in *very abundant* or *abundant* quantities in the net catches are taken into consideration. Genera represented in small numbers in the net catches are given in the tables (Tables 6–13).

The following are notes on the seasonal distribution and occurrence of genera recorded in the net catches (see Plates 1–4).

*Autumn*, 1954.

The following genera were abundant or very abundant in the net catches made during autumn.

*Chaetoceros.*—This genus occurred at all the stations in the St. Helena Bay area and was therefore widely distributed. This is one of the important food diatoms in the plankton succession.

*Ceratium.—Ceratium* occurred only at stations JJ and N situated near the coast; the genus was therefore distributed over a limited area.

*Prorocentrum.*—This genus was present at stations M, N, JJ, NN and Q, all of which are situated near the coast.

*Coscinodiscus* occurred at stations Q, O, M and PP and was therefore very widely distributed over the area.

The following genera occurred only in small numbers in the net catches during autumn: *Asterionella, Peridinium, Thalassiosira, Pleurosigma, Licmophora, Nitzschia, Glenodinium, Biddulphia, Rhizosolenia, Navicula* and *Corethron.* A total of fifteen phytoplankton genera therefore occurred in the fishing area during autumn.

*Winter*, 1954.

The following genera were abundant or very abundant during winter.

*Chaetoceros.*—This genus was found at all stations except at station JJ. *Chaetoceros* was as widely distributed as during autumn.

*Peridinium.*—This genus occurred only at stations N and PP situated near the coast.

*Nizschia.—Nitzschia* occurred at all stations except at station JJ; as in the case of *Chaetoceros*, this genus had a wide distribution.

*Thalassiosira.*—This genus was found only at stations M and N; these stations are situated close to the shore.

*Skeletonema* was found only at stations O and Q situated at a greater distance (Fig. 1) from the coast.

*Thalassiosira subtilis* was recorded only at station M, situated in the northern part of the area, near the coast.

The following genera occurred in small volumes in the area during winter: *Coscinodiscus, Prorocentrum, Ceratium, Asterionella, Biddulphia, Dinophysis, Triceratium, Corethron, Pleurosigma, Licmophora, Eucampia, Thalassionema, Planktoniella, Hemiaulus, Rhizosolenia* and *Guinardia.* Genera occurring in the net catches during winter totalled 22.

*Spring*, 1954.

During this season a large number of genera occurred in *abundant* or *very abundant* quantities in the net catches.

*Chaetoceros.*—This genus was once again distributed over the entire area.

*Nitzschia* occurred at stations M, JJ, NN, N and PP all of which are situated near the coast.

*Thalassiosira* was found at stations L, M, JJ, N, NN and PP and therefore had mainly a coastal distribution.

*Rhizosolenia* occurred only at station L.

*Skeletonema* occurred at all the stations in the area and was therefore widely distributed.

*Asterionella* was recorded only at stations M, JJ and N. These stations are all situated in the northern part of the area near the coast.

*Thalassiosira subtilis* occurred only at station L.

*Biddulphia* was recorded only at station PP near the coast.

The following genera occurred in small numbers: *Coscinodiscus, Pleurosigma, Prorocentrum, Corethron, Thalassionema, Hemiaulus, Stephanopyxis, Navicula, Peridinium, Ceratium, Dinophysis, Leptocylindrus, Chaetoceros socialis* and *Schröderella.* Twenty-two genera occurred in the area during spring.

*Summer*, 1954.

*Chaetoceros* again occurred at all the stations in the area. During every season of the year this important food diatom had a wide distribution in St. Helena Bay.

*Ceratium*.—This genus was found only in the northern part of the area at stations L, M and N.

*Peridinium*.—This genus was present at only two stations (L and Q).

Small numbers of the following genera were recorded in the area: *Coscinodiscus*, *Pleurosigma*, *Dinophysis*, *Prorocentrum*, *Nitzschia*, *Stephanopyxis*, *Rhizosolenia*, *Thalassiosira*, *Corethron*, *Eucampia*, *Skeletonema*, *Asterionella*, *Thalassionema*, *Biddulphia*, *Hemiaulus*, *Lauderia* and *Thalassiothrix*.

A total of 20 genera were present in the area during summer.

The analyses of the net catches made at these stations show that phytoplankton occurred in the commercial fishing area during every month of the year. The following genera often occurred in good quantities in the net catches.

*Chaetoceros* was distributed over the entire area during all seasons.

*Nitzschia* occurred in good quantities during two seasons of the year. During winter this genus was found at all stations near the coast and during spring it was distributed over the entire area.

*Skeletonema* occurred in considerable quantities during winter and spring. During winter this genus was recorded at two stations situated farther away from the coast; during spring it was distributed over the whole area.

*Thalassiosira* occurred in large numbers during spring and winter. The genus was found mainly near the coast.

*Asterionella*.—This genus occurred in good quantities only during spring in the northern part of the commercial fishing area at stations near the coast.

*Rhizosolenia* was recorded at only one station in the northern part of the area.

*Coscinodiscus*.—During autumn this genus was widely distributed; during the other seasons only small numbers were found.

*Biddulphia* was recorded at only one station in the southern part of the area near the coast.

*Prorocentrum* occurred at all stations situated near the coast during autumn. During the season when this genus was present, the water in a large part of the area was characterized by a red colour.

*Ceratium* occurred during summer and autumn. It was distributed mainly near the coast in the northern part of the area.

*Peridinium* was recorded during winter and summer; during winter the genus was distributed near the coast and in summer it was found at greater distances from the coast.

The genera of which only small numbers were recorded in the net catches made in the commercial fishing area are given in Tables 6–13 (see pages 45–52).

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TABLE 6.

SEASONAL OCCURRENCE OF PHYTOPLANKTON AT STATION L, 1954 (N50V, 50–0 METRES).

| Genera | Summer | | | Autumn | | | Winter | | | Spring | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dec. | Jan. | Feb. | March | April | May | June | July | Aug. | Sept. | Oct. | Nov. |
| *Peridinium* | R | A | R | R | R | R | R | — | — | R | R | R |
| *Ceratium* | — | C | R | R | R | R | — | — | R | — | — | — |
| *Coscinodiscus* | — | R | — | R | R | R | R | R | — | — | R | — |
| *Chaetoceros* | A | R | R | — | R | C | A | — | R | C | — | A |
| *Pleurosigma* | — | R | — | — | — | — | — | — | R | — | R | — |
| *Dinophysis* | R | R | R | — | — | — | — | — | — | — | — | — |
| *Prorocentrum* | — | — | — | R | R | R | R | — | — | — | — | R |
| *Corethron* | — | — | — | — | R | R | — | — | R | R | — | R |
| *Nitzschia* | — | — | — | — | — | — | A | — | — | R | — | R |
| *Biddulphia* | — | — | — | — | — | — | R | R | R | — | — | — |
| *Thalassiosira* | — | — | — | — | — | — | R | — | — | R | R | C |
| *Thalassiosira subtilis* | — | — | — | — | — | — | — | — | R | A | — | — |
| *Thalassionema* | — | — | — | — | — | — | — | — | R | R | — | — |
| *Licmophora* | — | — | — | — | — | — | — | — | R | — | — | — |
| *Planktoniella* | — | — | — | — | — | — | — | — | R | — | — | — |
| *Hemiaulus* | — | — | — | — | — | — | — | — | R | — | R | — |
| *Rhizosolenia* | — | — | — | — | — | — | — | — | R | C | R | — |
| *Guinardia* | — | — | — | — | — | — | — | — | R | — | — | — |
| *Skeletonema* | — | — | — | — | — | — | — | — | — | R | R | A |
| *Stephanopyxis* | — | — | — | — | — | — | — | — | — | R | — | — |
| *Asterionella* | — | — | — | — | — | — | — | — | — | — | R | — |
| *Navicula* | — | — | — | — | — | — | — | — | — | — | — | R |

A = occurrence of genus *very abundant*. C = occurrence of genus *abundant*. R = occurrence of genus *scarce*.



*Reprint from "Commerce & Industry", April, 1957*

## Table 7.

### Seasonal Occurrence of Phytoplankton at Station M, 1954 (N50V, 50–0 Metres).

| Genera | Summer | | | Autumn | | | Winter | | | Spring | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dec. | Jan. | Feb. | March | April | May | June | July | Aug. | Sept. | Oct. | Nov. |
| *Chaetoceros* | A | C | — | R | — | — | A | — | C | A | A | A |
| *Peridinium* | R | R | R | R | — | R | R | R | — | R | R | R |
| *Ceratium* | — | R | A | A | — | — | — | — | R | — | — | R |
| *Coscinodiscus* | — | R | — | — | — | R | R | R | R | — | — | R |
| *Dinophysis* | R | R | R | — | — | — | — | — | — | — | — | — |
| *Prorocentrum* | R | — | — | A | — | R | — | — | — | — | — | R |
| *Rhizosolenia* | — | — | — | — | — | R | — | — | R | R | — | R |
| *Biddulphia* | — | — | — | — | — | R | R | — | R | R | — | — |
| *Navicula* | — | — | — | — | — | R | — | — | — | — | — | — |
| *Nitzschia* | — | — | — | — | — | — | A | — | — | R | R | A |
| *Thalassiosira* | — | — | — | — | — | — | R | — | C | R | R | C |
| *Thalassionema* | — | — | — | — | — | — | R | — | R | — | — | — |
| *Corethron* | — | — | — | — | — | — | — | R | R | R | R | R |
| *Thalassiosira subtilis* | — | — | — | — | — | — | — | — | C | — | — | — |
| *Licmophora* | — | — | — | — | — | — | — | — | R | — | — | — |
| *Plantoniella* | — | — | — | — | — | — | — | — | R | — | — | — |
| *Pleurosigma* | — | — | — | — | — | — | — | — | R | — | R | — |
| *Hemiaulus* | — | — | — | — | — | — | — | — | R | — | — | — |
| *Asterionella* | — | — | — | — | — | — | — | — | R | C | — | R |
| *Skeletonema* | — | — | — | — | — | — | — | — | — | R | C | — |
| *Leptocylindrus* | — | — | — | — | — | — | — | — | — | R | — | R |

A = occurrence of genus *very abundant*. C = occurrence of genus *abundant*. R = occurrence of genus *scarce*.

TABLE 8.—SEASONAL OCCURRENCE OF PHYTOPLANKTON AT STATION N, 1954 (N50V, 50–0 METRES).

| Genera | Summer | | | Autumn | | | Winter | | | Spring | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dec. | Jan. | Feb. | March | April | May | June | July | Aug. | Sept. | Oct. | Nov. |
| *Chaetoceros* | A | A | R | A | A | R | C | — | R | A | A | A |
| *Nitzschia* | R | R | — | — | — | — | A | — | — | R | A | R |
| *Ceratium* | — | R | C | A | — | — | — | — | — | — | — | — |
| *Pleurosigma* | — | R | R | — | | — | R | — | — | — | R | — |
| *Peridinium* | R | R | R | R | R | R | C | R | — | R | R | R |
| *Dinophysis* | — | R | R | — | — | — | R | — | R | — | R | — |
| *Stephanopyxis* | — | — | R | — | — | — | — | — | — | R | — | R |
| *Coscinodiscus* | — | — | R | C | R | R | R | R | — | — | — | R |
| *Rhizosolenia* | R | — | R | — | — | — | R | — | — | R | R | — |
| *Prorocentrum* | — | — | — | A | A | R | R | — | — | — | — | R |
| *Glenodinium* | — | — | — | R | — | — | — | — | — | — | — | — |
| *Biddulphia* | — | — | — | — | R | — | R | — | R | R | R | — |
| *Thalassiosira* | R | — | — | — | — | — | A | — | R | A | C | C |
| *Skeletonema* | — | — | — | — | — | — | R | — | — | — | A | — |
| *Thalassiosira subtilis* | — | — | — | — | — | — | — | — | R | — | — | — |
| *Asterionella* | — | — | — | — | — | — | — | — | R | C | R | — |
| *Thalassionema* | — | — | — | — | — | — | — | — | R | R | R | — |
| *Hemiaulus* | — | — | — | — | — | — | — | — | R | R | R | — |
| *Corethron* | R | — | — | — | — | — | — | — | R | R | R | — |
| *Licmophora* | — | — | — | — | — | — | — | — | R | — | — | — |
| *Planktoniella* | — | — | — | — | — | — | — | — | R | — | — | — |
| *Leptocylindrus* | — | — | — | — | — | — | — | — | — | R | R | — |
| *Chaetoceros socialis* | — | — | — | — | — | — | — | — | — | — | — | R |
| *Eucampia* | R | — | — | — | — | — | — | — | — | — | — | — |

A = occurrence of genus *very abundant*. C = occurrence of genus *abundant*. R = occurrence of genus *scarce*.



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## Table 9.

### Seasonal Occurrence of Phytoplankton at Station Q, 1954 (N50V, 50–0 Metres)

| Genera | Summer | | | Autumn | | | Winter | | | Spring | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dec. | Jan. | Feb. | March | April | May | June | July | Aug. | Sept. | Oct. | Nov. |
| *Peridinium* | R | C | R | R | R | — | R | R | — | — | — | R |
| *Chaetoceros* | C | C | C | A | R | — | A | — | — | — | R | A |
| *Coscinodiscus* | — | R | R | R | A | — | R | R | — | — | — | R |
| *Ceratium* | — | R | R | R | R | — | — | R | — | — | — | — |
| *Stephanopyxis* | R | — | R | — | — | — | — | — | — | — | — | R |
| *Prorocentrum* | — | — | — | C | R | — | R | — | — | — | — | — |
| *Glenodinium* | — | — | — | R | — | — | — | — | — | — | — | — |
| *Nitzschia* | R | — | — | — | — | — | A | R | — | — | R | R |
| *Skeletonema* | R | — | — | — | — | — | C | — | — | — | C | R |
| *Thalassiosira* | R | — | — | — | — | — | R | — | — | — | R | R |
| *Thalassionema* | R | — | — | — | — | — | R | — | — | — | R | — |
| *Corethron* | R | — | — | — | — | — | R | — | — | — | R | — |
| *Asterionella* | R | — | — | — | — | — | R | — | — | — | — | — |
| *Pleurosigma* | — | — | — | — | — | — | R | — | — | — | — | — |
| *Biddulphia* | R | — | — | — | — | — | — | R | — | — | — | — |
| *Hemiaulus* | R | — | — | — | — | — | — | — | — | — | R | — |
| *Leptocylindrus* | — | — | — | — | — | — | — | — | — | — | R | — |
| *Dinophysis* | — | — | — | — | — | — | — | — | — | — | — | R |
| *Rhizosolenia* | R | — | — | — | — | — | — | — | — | — | — | — |

A = occurrence of genus *very abundant*. C = occurrence of genus *abundant*. R = occurrence of genus *scarce*.

TABLE 10.

SEASONAL OCCURRENCE OF PHYTOPLANKTON AT STATION O, 1954 (N50V, 50–0 METRES).

| Genera | Summer | | | Autumn | | | Winter | | | Spring | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dec. | Jan. | Feb. | March | April | May | June | July | Aug. | Sept. | Oct. | Nov. |
| *Chaetoceros* | A | C | R | A | R | — | A | R | R | — | C | A |
| *Ceratium* | — | R | — | R | R | — | — | R | — | — | — | — |
| *Peridinium* | - | R | — | R | R | R | R | R | — | — | R | R |
| *Coscinodiscus* | — | R | R | A | R | R | C | R | R | — | — | R |
| *Nitzschia* | R | R | — | R | — | — | A | — | — | — | R | R |
| *Pleurosigma* | R | R | — | — | — | — | — | — | — | — | — | — |
| *Dinophysis* | — | R | — | — | — | — | — | — | — | — | — | — |
| *Prorocentrum* | — | — | — | R | R | R | — | — | — | — | — | — |
| *Glenodinium* | — | — | — | R | — | — | — | — | — | — | — | — |
| *Skeletonema* | R | — | — | — | — | — | C | — | — | — | C | C |
| *Thalassiosira* | R | — | — | — | — | — | R | — | R | — | R | R |
| *Thalassionema* | — | — | — | — | — | — | R | — | R | — | R | — |
| *Asterionella* | R | — | — | — | — | — | R | — | — | — | R | R |
| *Rhizosolenia* | — | — | — | — | — | — | R | R | — | — | R | R |
| *Biddulphia* | — | — | — | — | — | — | R | — | R | — | — | — |
| *Eucampia* | — | — | — | — | — | — | R | — | — | — | — | — |
| *Planktoniella* | — | — | — | — | — | — | — | — | R | — | — | — |
| *Corethron* | — | — | — | — | — | — | — | — | R | — | — | — |
| *Thalassiosira subtilis* | — | — | — | — | — | — | — | — | R | — | — | — |
| *Licmophora* | — | — | — | — | — | — | — | — | R | — | — | — |
| *Hemiaulus* | — | — | — | — | — | — | — | — | R | — | R | — |
| *Leptocylindrus* | — | — | — | — | — | — | — | — | — | — | R | — |

A = occurrence of genus *very abundant*. C = occurrence of genus *abundant*. R = occurrence of genus *scarce*.



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## Table 11.

### Seasonal Occurrence of Phytoplankton at Station PP, 1954 (N50V, 50–0 Metres).

| Genera | Summer | | | Autumn | | | Winter | | | Spring | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dec. | * Jan. | * Feb. | March | * April | May | June | July | Aug. | Sept. | Oct. | Nov. |
| *Coscinodiscus* | — | | | C | | R | R | R | R | — | — | — |
| *Prorocentrum* | — | | | R | | R | R | — | — | — | — | R |
| *Chaetoceros* | A | | | R | | A | R | — | R | A | A | R |
| *Ceratium* | — | | | R | | — | R | R | — | — | R | — |
| *Asterionella* | — | | | R | | — | — | — | — | R | R | R |
| *Peridinium* | R | | | R | | R | R | C | R | R | R | R |
| *Thalassiosira* | R | | | — | | R | — | — | — | C | C | R |
| *Pleurosigma* | R | | | — | | R | — | — | — | — | — | — |
| *Nitzschia* | R | | | — | | — | C | — | — | A | A | R |
| *Biddulphia* | — | | | — | | — | R | R | R | C | — | R |
| *Dinophysis* | — | | | — | | — | R | — | — | — | — | R |
| *Triceratium* | — | | | — | | — | — | R | R | — | — | — |
| *Corethron* | — | | | — | | — | — | — | R | R | R | R |
| *Thalassionema* | — | | | — | | — | — | — | — | R | R | R |
| *Skeletonema* | — | | | — | | — | — | — | — | — | C | A |
| *Leptocylindrus* | — | | | — | | — | — | — | — | — | R | — |
| *Rhizosolenia* | R | | | — | | — | — | — | — | — | R | — |
| *Chaetoceros socialis* | — | | | — | | — | — | — | — | — | — | R |
| *Stephanopyxis* | — | | | — | | — | — | — | — | — | — | R |
| *Hemiaulus* | R | | | — | | — | — | — | — | — | — | — |
| *Thalassiothrix* | R | | | — | | — | — | — | — | — | — | — |

A = occurrence of genus *very abundant*. C = occurrence of genus *abundant*. R = occurrence of genus *scarce*.

SEASONAL OCCURRENCE OF PHYTOPLANKTON AT STATION NN, 1954 (N50V, 50–0 METRES).

| Genera | Summer | | | Autumn | | | Winter | | | Spring | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dec. | * Jan. | * Feb. | March | * April | May | June | July | Aug. | Sept. | Oct. | Nov. |
| *Chaetoceros* | A | | | A | | C | A | R | R | A | C | R |
| *Prorocentrum* | — | | | A | | R | R | — | — | — | — | — |
| *Asterionella* | — | | | R | | — | — | — | — | R | R | — |
| *Coscinodiscus* | — | | | R | | — | R | R | R | R | — | — |
| *Pleurosigma* | — | | | R | | R | R | – | — | – | — | R |
| *Ceratium* | – | | | R | | R | – | – | – | — | — | — |
| *Peridinium* | R | | | R | | R | — | R | R | — | R | R |
| *Licmophora* | — | | | R | | — | R | — | — | — | — | — |
| *Nitzschia* | R | | | — | | R | A | — | — | C | R | R |
| *Thalassiosira* | R | | | — | | — | R | — | — | C | R | C |
| *Dinophysis* | R | | | — | | — | R | — | — | — | — | R |
| *Biddulphia* | — | | | — | | — | R | R | R | R | — | R |
| *Eucampia* | R | | | — | | — | R | — | — | — | — | — |
| *Corethron* | — | | | — | | — | — | — | R | R | — | R |
| *Thalassionema* | — | | | — | | — | — | — | — | R | — | R |
| *Chaetoceros socialis* | — | | | — | | — | — | — | — | R | — | R |
| *Stephanopyxis* | R | | | — | | — | — | — | — | — | R | R |
| *Skeletonema* | R | | | — | | — | — | — | — | — | R | A |
| *Leptocylindrus* | — | | | — | | — | — | — | — | — | R | — |
| *Schröderella* | — | | | — | | — | — | — | — | — | — | R |
| *Lauderia* | R | | | — | | — | — | — | — | — | — | — |
| *Rhizosolenia* | R | | | — | | — | — | — | — | — | — | — |

A = occurrence of genus *very abundant*. C = occurrence of genus *abundant*. R = occurrence of genus *scarce*.

* No data available.

## Table 13.

### Seasonal Occurrence of Phytoplankton at Station JJ, 1954 (N50V, 50–0 Metres).

| Genera | Summer | | | Autumn | | | Winter | | | Spring | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dec. | * Jan. | * Feb. | March | * April | May | June | July | Aug. | Sept. | Oct. | Nov. |
| *Prorocentrum* | R | | | A | | R | R | — | — | — | — | R |
| *Ceratium* | — | | | A | | – | | — | – | — | – | — |
| *Peridinium* | R | | | R | | R | R | — | | — | R | R |
| *Coscinodiscus* | – | | | R | | – | R | R | R | R | — | R |
| *Chaetoceros* | A | | | – | | A | R | — | R | C | C | A |
| *Thalassiosira* | R | | | – | | R | R | – | — | R | A | R |
| *Pleurosigma* | R | | | – | | R | — | — | — | — | — | R |
| *Nitzschia* | R | | | – | | | R | — | – | C | R | R |
| *Skeletonema* | R | | | – | | | R | — | — | — | A | R |
| *Dinophysis* | R | | | – | | – | R | — | — | R | — | – |
| *Biddulphia* | R | | | | | | | R | R | R | — | — |
| *Corethron* | R | | | | | | | – | R | R | R | R |
| *Thalassionema* | – | | | – | | | | | – | R | — | R |
| *Asterionella* | — | | | | | | | | | | C | — |
| *Leptocylindrus* | — | | | | | | | — | — | – | R | — |
| *Chaetoceros socialis* | | | | — | | | | | | | — | C |
| *Schröderella* | — | | | | | | | | | – | – | R |
| *Stephanopyxis* | — | | | | | | — | | – | — | – | R |
| *Rhizosolenia* | — | | | — | | | | – | | – | — | R |

A = occurrence of genus *very abundant*. C = occurrence of genus *abundant*. R = occurrence of genus *scarce*.

* No data available.

## Table 14.

### Depth Distribution of Phytoplankton at Station DA—Quantitative Aspect (0 Metres).

| Phytoplankton Genera | *Chaetoceros socialis* | *Chaetoceros* | *Nitzschia* | *Thalassiosira* | *Skeletonema* | *Ceratium* | *Prorocentrum* | *Pleurosigma* | *Leptocylindrus* | *Dinophysis* | *Peridinium* | *Coscinodiscus* | *Schröderella* | *Asterionella* | *Biddulphia* | *Thalassionema* | *Hemiaulus* | *Planktoniella* | *Corethron* | *Rhizosolenia* | *Tintinnid* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1954 | Percentages of Catches. | | | | | | | | | | | | | | | | | | | | |
| January | 40·6 | 15·6 | 12·5 | 3·1 | 0·0 | 17·2 | 0·0 | 3·1 | 4·7 | 1·6 | 1·6 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| February | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| March | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 18·7 | 75·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| April | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| May | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| June | 0·0 | 10·7 | 32·1 | 41·4 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 15·7 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| July | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| August | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| September | 0·0 | 52·6 | 13·8 | 13·4 | 0·0 | 0·0 | 0·0 | 0·4 | 6·9 | 0·0 | 0·0 | 0·0 | 0·0 | 10·5 | 1·1 | 0·7 | 0·5 | 0·0 | 0·0 | 0·0 | 0·0 |
| October | 0·0 | 2·0 | 7·1 | 2·0 | 87·9 | 0·0 | 0·0 | 1·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | p·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| November | 0·0 | 89·2 | 1·4 | 1·4 | 0·0 | 0·0 | 0·0 | 1·4 | 0·0 | 0·0 | 5·0 | 0·7 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·7 | 0·0 |
| December | 0·0 | 98·3 | 1·5 | 0·0 | 0·0 | 0·0 | 0·2 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |



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## Table 15.

### Depth Distribution of Phytoplankton at Station DA—Quantitative Aspect (5 Metres).

| Phytoplankton Genera | *Chaetoceros socialis* | *Chaetoceros* | *Nitzschia* | *Thalassiosira* | *Skeletonema* | *Ceratium* | *Prorocentrum* | *Pleurosigma* | *Leptocylindrus* | *Dinophysis* | *Peridinium* | *Coscinodiscus* | *Schröderella* | *Asterionella* | *Biddulphia* | *Thalassionema* | *Hemiaulus* | *Planktoniella* | *Corethron.* | *Rhizosolenia* | *Tintinnid* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1954 | Percentages of Catches | | | | | | | | | | | | | | | | | | | | |
| January | 3·7 | 59·7 | 6·1 | 0·0 | 0·0 | 24·4 | 0·0 | 3·7 | 0·0 | 0·0 | 2·4 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| February | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| March | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 41·7 | 50·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| April | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 8·3 |
| May | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| June | 0·0 | 5·1 | 19·2 | 65·4 | 0·0 | 0·0 | 0·0 | 1·3 | 0·0 | 0·0 | 0·0 | 0·0 | 9·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| July | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| August | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| September | 0·0 | 49·5 | 17·7 | 11·8 | 0·0 | 0·0 | 1·2 | 0·3 | 4·8 | 0·0 | 0·2 | 0·0 | 0·0 | 11·3 | 0·2 | 0·7 | 3·2 | 0·2 | 0·0 | 0·0 | 0·0 |
| October | 0·0 | 0·0 | 6·6 | 6·6 | 86·8 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| November | 0·0 | 93·3 | 0·4 | 5·2 | 0·0 | 0·0 | 0·0 | 0·4 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| December | 0·0 | 99·7 | 0·1 | 0·0 | 0·0 | 0·0 | 0·1 | 0·1 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·3 | 0·4 | 0·0 |

## Table 16.

### Depth Distribution of Phytoplankton at Station DA—Quantitative Aspect (10 Metres).

| Phytoplankton Genera | *Chaetoceros socialis* | *Chaetoceros* | *Nitzschia* | *Thalassiosira* | *Skeletonema* | *Ceratium* | *Prorocentrum* | *Pleurosigma* | *Leptocylindrus* | *Dinophysis* | *Peridinium* | *Coscinodiscus* | *Schröderella* | *Asterionella* | *Biddulphia* | *Thalassionema* | *Hemiaulus* | *Planktoniella* | *Corethron* | *Rhizosolenia* | *Tintinnid* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1954 | Percentages of Catches | | | | | | | | | | | | | | | | | | | | |
| January | 23·9 | 44·0 | 4·6 | 1·8 | 0·0 | 21·1 | 0·0 | 1·8 | 0·0 | 0·9 | 1·8 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| February | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| March | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 80·0 | 20·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| April | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| May | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| June | 0·0 | 3·5 | 13·9 | 68·2 | 0·0 | 0·0 | 0·6 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 13·9 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| July | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| August | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| September | 0·0 | 56·0 | 10·3 | 12·8 | 0·0 | 0·0 | 0·0 | 0·0 | 7·8 | 0·0 | 0·0 | 0·0 | 0·0 | 7·6 | 0·0 | 1·1 | 4·4 | 0·0 | 0·0 | 0·0 | 0·0 |
| October | 0·0 | 0·0 | 0·0 | 0·0 | 100·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| November | 0·0 | 96·7 | 0·0 | 2·1 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| December | 0·0 | 98·2 | 1·2 | 0·2 | 0·0 | 0·0 | 0·1 | 0·1 | 0·0 | 0·0 | 0·1 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |



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## Table 17.

### Depth Distribution of Phytoplankton at Station DA—Quantitative Aspect (20 Metres).

| Phytoplankton Genera | *Chaetoceros socialis* | *Chaetoceros* | *Nitzschia* | *Thalassiosira* | *Skeletonema* | *Ceratium* | *Prorocentrum* | *Pleurosigma* | *Leptocylindrus* | *Dinophysis* | *Peridinium* | *Coscinodiscus* | *Schröderella* | *Asterionella* | *Biddulphia* | *Thalassionema* | *Hemiaulus* | *Planktoniella* | *Corethron* | *Rhizosolenia* | *Tintinnid* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1954 | Percentages of Catches | | | | | | | | | | | | | | | | | | | | |
| January | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| February | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| March | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| April | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| May | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| June | 0·0 | 3·5 | 10·2 | 59·3 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 27·1 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| July | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| August | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| September | 0·0 | 66·5 | 3·7 | 14·3 | 0·0 | 0·0 | 0·0 | 0·3 | 4·8 | 0·0 | 0·0 | 0·0 | 0·0 | 10·2 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| October | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| November | 0·0 | 93·8 | 0·8 | 5·3 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| December | 0·0 | 99·5 | 0·1 | 0·1 | 0·0 | 0·0 | 0·0 | 0·2 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |

## Table 18.

### Depth Distribution of Phytoplankton at Station DA—Quantitative Aspect (30 Metres).

| Phytoplankton Genera | *Chaetoceros socialis* | *Chaetoceros* | *Nitzschia* | *Thalassiosira* | *Skeletonema* | *Ceratium* | *Prorocentrum* | *Pleurosigma* | *Leptocylindrus* | *Dinophysis* | *Peridinium* | *Coscinodiscus* | *Schröderella* | *Asterionella* | *Biddulphia* | *Thalassionema* | *Hemiaulus* | *Planktoniella* | *Corethron* | *Rhizosolenia* | *Tintinnid* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1954 | Percentages of Catches | | | | | | | | | | | | | | | | | | | | |
| January | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| February | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| March | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| April | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| May | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| June | 0·0 | 4·7 | 20·7 | 52·7 | 0·0 | 0·0 | 1·2 | 0·0 | 0·0 | 0·0 | 1·2 | 0·0 | 19·5 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| July | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| August | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| September | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| October | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| November | 0·0 | 91·3 | 0·0 | 8·7 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| December | 0·0 | 100·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |



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## Table 19.

### Depth Distribution of Phytoplankton at Station DA—Quantitative Aspect (50 Metres).

| Phytoplankton Genera | *Chaetoceros socialis* | *Chaetoceros* | *Nitzschia* | *Thalassiosira* | *Skeletonema* | *Ceratium* | *Prorocentrum* | *Pleurosigma* | *Leptocylindrus* | *Dinophysis* | *Peridinium* | *Coscinodiscus* | *Schröderella* | *Asterionella* | *Biddulphia* | *Thalassionema* | *Hemiaulus* | *Planktoniella* | *Corethron* | *Rhizosolenia* | *Tintinnid* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1954 | Percentages of Catches | | | | | | | | | | | | | | | | | | | | |
| January | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| February | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| March | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| April | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| May | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| June | 0·0 | 0·0 | 0·0 | 100·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| July | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| August | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| September | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| October | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| November | 0·0 | 0·0 | 0·0 | 100·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| December | 0·0 | 100·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |

## Table 20.

### Depth Distribution of Phytoplankton at Station DB—Quantitative Aspect (0 Metres).

| Phytoplankton Genera | *Chaetoceros socialis* | *Chaetoceros* | *Nitzschia* | *Thalassiosira* | *Skeletonema* | *Ceratium* | *Prorocentrum* | *Pleurosigma* | *Leptocylindrus* | *Dinophysis* | *Peridinium* | *Asterionella* | *Bidduphia* | *Thalassionema* | *Hemiaulus* | *Corethron* | *Rhizosolenia* | *Stephanopyxis* | *Licmophora* | *Navicula* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1954 | Percentages of Catches | | | | | | | | | | | | | | | | | | | |
| January | 5·3 | 36·5 | 57·1 | 0·0 | 0·0 | 0·4 | 0·0 | 0·0 | 0·0 | 0·0 | 0·4 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·2 | 0·0 |
| February | 0·0 | 43·5 | 30·4 | 0·0 | 0·0 | 26·1 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| March | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| April | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| May | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| June | 0·0 | 20·0 | 28·0 | 14·7 | 18·7 | 0·0 | 0·0 | 4·0 | 0·0 | 0·0 | 0·0 | 14·7 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| July | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| August | 0·0 | 0·0 | 8·1 | 89·2 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 2·7 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| September | 0·0 | 18·2 | 26·1 | 27·5 | 2·1 | 0·0 | 0·0 | 0·0 | 12·0 | 0·0 | 0·0 | 12·0 | 0·0 | 2·1 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| October | 0·0 | 4·7 | 12·3 | 1·0 | 80·0 | 0·0 | 0·0 | 0·0 | 0·3 | 0·0 | 0·0 | 1·1 | 0·0 | 0·0 | 0·5 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| November | 0·0 | 84·9 | 0·0 | 9·2 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 1·1 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 3·8 | 1·1 | 0·0 | 0·0 |
| December | 0·0 | 46·1 | 9·9 | 4·2 | 36·0 | 0·0 | 0·0 | 0·2 | 0·0 | 0·0 | 0·0 | 3·4 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |



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## Table 21

### Depth Distribution of Phytoplankton at Station DB—Quantitative Aspect (5 Metres).

| Phytoplankton Genera | *Chaetoceros socialis* | *Chaetoceros* | *Nitzschia* | *Thalassiosira* | *Skeletonema* | *Ceratium* | *Prorocentrum* | *Pleurosigma* | *Leptocylindrus* | *Dinophysis* | *Peridinium* | *Asterionella* | *Biddulphia* | *Thalassionema* | *Hemiaulus* | *Corethron* | *Rhizosolenia* | *Stephanopyxis* | *Licmophora* | *Navicula* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1954 | Percentages of Catches | | | | | | | | | | | | | | | | | | | |
| January | 1·8 | 48·7 | 49·2 | 0·0 | 0·0 | 0·2 | 0·0 | 0·1 | 0·0 | 0·0 | 0·1 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| February | 0·0 | 71·8 | 2·6 | 0·0 | 0·0 | 12·8 | 0·0 | 0·0 | 7·7 | 5·1 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| March | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| April | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| May | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| June | 0·0 | 38·1 | 2·4 | 47·6 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 11·9 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| July | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| August | 0·0 | 41·8 | 7·6 | 48·1 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| September | 0·0 | 27·8 | 16·0 | 32·5 | 0·0 | 0·0 | 0·0 | 0·0 | 10·3 | 0·0 | 0·0 | 9·5 | 0·0 | 1·1 | 2·8 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| October | 0·0 | 6·7 | 21·4 | 4·9 | 66·1 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·6 | 0·0 | 0·3 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| November | 0·0 | 88·6 | 0·0 | 8·7 | 0·0 | 0·0 | 0·2 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·4 | 0·9 | 0·9 | 0·0 | 0·2 |
| December | 0·0 | 78·3 | 6·1 | 2·5 | 11·1 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 2·1 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |

## Table 22.

### Depth Distribution of Phytoplankton at Station DB—Quantitative Aspect (10 Metres).

| Phytoplankton Genera | *Chaetoceros socialis* | *Chaetoceros* | *Nitzschia* | *Thalassiosira* | *Skeletonema* | *Ceratium* | *Prorocentrum* | *Pleurosigma* | *Leptocylindrus* | *Dinophysis* | *Peridinium* | *Asterionella* | *Bidduiphia* | *Thalassionema* | *Hemiaulus* | *Corethron* | *Rhizosolenia* | *Stephanopyxis* | *Licmophora* | *Navicula* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1954 | Percentages of Catches | | | | | | | | | | | | | | | | | | | |
| January | 8·1 | 33·4 | 57·0 | 0·0 | 0·0 | 0·8 | 0·0 | 0·3 | 0·0 | 0·1 | 0·3 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| February | 0·0 | 44·4 | 5·5 | 0·0 | 0·0 | 50·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| March | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| April | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| May | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| June | 0·0 | 23·8 | 14·3 | 42·9 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 19·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| July | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| August | 0·0 | 14·6 | 0·0 | 78·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 7·3 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| September | 0·0 | 29·2 | 11·0 | 26·1 | 0·0 | 0·0 | 0·0 | 0·0 | 7·0 | 0·0 | 0·0 | 24·9 | 0·0 | 0·4 | 0·6 | 0·0 | 0·0 | 0·8 | 0·0 | 0·0 |
| October | 0·0 | 3·5 | 16·2 | 0·8 | 77·9 | 0·0 | 0·0 | 0·4 | 0·6 | 0·0 | 0·2 | 0·0 | 0·0 | 0·4 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| November | 0·0 | 85·1 | 4·0 | 10·4 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·5 | 0·0 | 0·0 | 0·0 |
| December | 0·0 | 91·7 | 1·5 | 1·5 | 5·1 | 0·0 | 0·0 | 0·2 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |



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## Table 23.

### Depth Distribution of Phytoplankton at Station DB—Quantitative Aspect (20 Metres).

| Phytoplankton Genera | *Chaetoceros socialis* | *Chaetoceros* | *Nitzschia* | *Thalassiosira* | *Skeletonema* | *Ceratium* | *Prorocentrum* | *Pleurosigma* | *Leptocylindrus* | *Dinophysis* | *Peridinium* | *Asterionella* | *Biddulphia* | *Thalassionema* | *Hemiaulus* | *Corethron* | *Rhizosolenia* | *Stephanopyxis* | *Licmophora* | *Navicula* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1954 | Percentages of Catches | | | | | | | | | | | | | | | | | | | |
| January | 3·2 | 19·8 | 71·7 | 0·0 | 0·0 | 2·6 | 0·0 | 1·7 | 0·0 | 0·9 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| February | 0·0 | 21·4 | 0·0 | 0·0 | 0·0 | 32·1 | 0·0 | 0·0 | 0·0 | 42·9 | 3·6 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| March | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| April | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| May | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| June | 0·0 | 24·2 | 15·1 | 24·2 | 27·3 | 0·0 | 0·0 | 9·1 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| July | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| August | 0·0 | 7·0 | 0·0 | 79·1 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 14·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| September | 0·0 | 36·9 | 13·0 | 29·3 | 0·0 | 0·0 | 0·0 | 0·0 | 9·8 | 0·0 | 0·0 | 9·1 | 0·7 | 0·0 | 0·7 | 0·0 | 0·4 | 0·0 | 0·0 | 0·0 |
| October | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| November | 0·0 | 68·7 | 0·0 | 29·2 | 0·0 | 0·0 | 0·0 | 2·1 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| December | 0·0 | 94·2 | 1·0 | 1·9 | 2·9 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |

## Table 24.

### Depth Distribution of Phytoplankton at Station DB—Quantitative Aspect (30 Metres).

| Phytoplankton Genera | *Chaetoceros socialis* | *Chaetoceros* | *Nitzschia* | *Thalassiosira* | *Skeletonema* | *Ceratium* | *Prorocentrum* | *Pleurosigma* | *Leptocylindrus* | *Dinophysis* | *Peridinium* | *Asterionella* | *Bidulphia* | *Thalassionema* | *Hemiaulus* | *Corethron* | *Rhizosolenia* | *Stephanopyxis* | *Licmophora* | *Navicula* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1954 | Percentages of Catches | | | | | | | | | | | | | | | | | | | |
| January | 0·0 | 62·1 | 35·8 | 0·0 | 0·0 | 0·0 | 0·0 | 1·1 | 0·0 | 0·0 | 1·1 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| February | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| March | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| April | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| May | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| June | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| July | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| August | 0·0 | 17·6 | 11·8 | 64·7 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| September | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 5·9 | 0·0 | 0·0 | 0·0 | 0·0 |
| October | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| November | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| December | 0·0 | 94·5 | 1·8 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 3·6 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |



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## Table 25.

### Depth Distribution of Phytoplankton at Station DB—Quantitative Aspect (50 Metres).

| Phytoplankton Genera | *Chaetoceros socialis* | *Chaetoceros* | *Nitzschia* | *Thalassiosira* | *Skeletonema* | *Ceratium* | *Prorocentrum* | *Pleurosigma* | *Leptocylindrus* | *Dinophysis* | *Peridinium* | *Asterionella* | *Bidulphia* | *Thalassionema* | *Hemiaulus* | *Corethron* | *Rhizosolenia* | *Stephanopyxis* | *Licmophora* | *Navicula* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1954 | Percentages of Catches | | | | | | | | | | | | | | | | | | | |
| January | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| February | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| March | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| April | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| May | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| June | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| July | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| August | 0·0 | 66·7 | 0·0 | 33·3 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| September | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| October | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| November | 0·0 | 100·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| December | 0·0 | 98·0 | 0·5 | 0·0 | 1·5 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |

## Table 26.

### Phytoplankton Counts, Station DA (0 Metres).

| Phytoplankton Genera | *Asterionella* | *Biddulphia* | *Ceratium* | *Ceratium tripos* | *Chaetoceros* | *Chaetoceros socialis* | *Coscinodiscus* | *Dictyocha* | *Hemiaulus* | *Leptocylindrus* | *Nitzschia* | *Peridinium* | *Pleurosigma* | *Prorocentrum* | *Rhizosolenia* | *Schröderella* | *Skeletonema* | *Thalassiosira* | *Thalassionema* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1954 | Number of cells/litre | | | | | | | | | | | | | | | | | | |
| January | 0 | 0 | 27,500 | 0 | 25,000 | 65,000 | 0 | 2,500 | 0 | 7,500 | 20,000 | 2,500 | 5,000 | 0 | 0 | 0 | 0 | 5,000 | 0 |
| February | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| March | 0 | 0 | 0 | 7,500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30,000 | 0 | 0 | 0 | 0 | 0 |
| April | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| May | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| June | 0 | 0 | 0 | 0 | 37,500 | 0 | 0 | 0 | 0 | 0 | 112,500 | 0 | 0 | 0 | 0 | 55,000 | 0 | 145,000 | 0 |
| July | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| August | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| September | 145,000 | 15,000 | 0 | 0 | 725,000 | 0 | 0 | 0 | 7,500 | 95,000 | 190,000 | 0 | 5,000 | 0 | 0 | 0 | 0 | 185,000 | 10,000 |
| October | 0 | 0 | 0 | 0 | 10,000 | 0 | 0 | 0 | 0 | 0 | 35,000 | 0 | 5,000 | 0 | 0 | 0 | 435,000 | 10,000 | 0 |
| November | 0 | 0 | 0 | 0 | 310,000 | 0 | 2,500 | 0 | 0 | 0 | 5,000 | 17,500 | 5,000 | 0 | 2,500 | 0 | 0 | 5,000 | 0 |
| December | 0 | 0 | 0 | 0 | 1,277,500 | 0 | 0 | 0 | 0 | 0 | 20,000 | 0 | 0 | 2,500 | 0 | 0 | 0 | 0 | 0 |



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## Table 27.

### Phytoplankton Counts, Station DA (5 Metres).

| Phytoplankton Genera | *Asterionella* | *Biddulphia* | *Ceratium* | *Ceratium tripos* | *Chaetoceros* | *Chaetoceros socialis* | *Hemiaulus* | *Leptocylindrus* | *Nitzschia* | *Peridinium* | *Planktoniella* | *Pleurosigma* | *Prorocentrum* | *Rhizosolenia* | *Schroderella* | *Skeletonema* | *Thalassionema* | *Thalassiosira* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1954 | Number of cells/litre | | | | | | | | | | | | | | | | | |
| January | 0 | 0 | 50,000 | 0 | 122,500 | 7,500 | 0 | 0 | 12,500 | 5,000 | 0 | 7,500 | 0 | 0 | 0 | 0 | 0 | 0 |
| February | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| March | 0 | 0 | 0 | 12,500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15,000 | 0 | 0 | 0 | 0 | 0 |
| April | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| May | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| June | 0 | 0 | 0 | 0 | 10,000 | 0 | 0 | 0 | 37,500 | 0 | 0 | 2,500 | 0 | 0 | 17,500 | 0 | 0 | 127,500 |
| July | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| August | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| September | 157,500 | 2,500 | 0 | 0 | 692,500 | 0 | 45,000 | 67,500 | 247,500 | 2,500 | 2,500 | 5,000 | 2,500 | 0 | 0 | 0 | 10,000 | 165,000 |
| October | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25,000 | 0 | 0 | 0 | 0 | 0 | 0 | 330,000 | 0 | 25,000 |
| November | 0 | 0 | 0 | 0 | 622,500 | 0 | 0 | 0 | 2,500 | 0 | 0 | 2,500 | 0 | 2,500 | 0 | 0 | 0 | 35,000 |
| December | 0 | 0 | 0 | 0 | 2,277,500 | 0 | 0 | 0 | 2,500 | 0 | 0 | 2,500 | 2,500 | 0 | 0 | 0 | 0 | 0 |

## Table 28.

### Phytoplankton Counts, Station DA (10 Metres).

| Phytoplankton Genera | *Asterionella* | *Ceratium* | *Chaetoceros* | *Chaetoceros socialis* | *Dinophysis* | *Hemiaulus* | *Leptocylindrus* | *Nitzschia* | *Peridinium* | *Pleurosigma* | *Prorocentrum* | *Schröderella* | *Skeletonema* | *Thalassionema* | *Thalassiosira* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1954 | Number of cells/litre | | | | | | | | | | | | | | |
| January | 0 | 57,500 | 120,000 | 65,000 | 2,500 | 0 | 0 | 12,500 | 5,000 | 5,000 | 0 | 0 | 0 | 0 | 5,000 |
| February | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| March | 0 | 10,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,500 | 0 | 0 | 0 | 0 |
| April | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| May | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| June | 0 | 0 | 15,000 | 0 | 0 | 0 | 0 | 60,000 | 0 | 0 | 2,500 | 60,000 | 0 | 0 | 295,000 |
| July | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| August | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| September | 107,500 | 0 | 790,000 | 0 | 0 | 62,500 | 110,000 | 145,000 | 0 | 0 | 0 | 0 | 0 | 15,000 | 180,000 |
| October | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 155,000 | 0 | 0 |
| November | 0 | 0 | 807,500 | 0 | 0 | 0 | 0 | 0 | 7,500 | 0 | 0 | 0 | 0 | 0 | 17,500 |
| December | 0 | 0 | 2,222,500 | 0 | 0 | 0 | 0 | 27,500 | 2,500 | 2,500 | 2,500 | 0 | 0 | 0 | 5,000 |



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TABLE 29.

PHYTOPLANKTON COUNTS, STATION DA (20 METRES).

| Phytoplankton Genera | *Asterionella* | *Chaetoceros* | *Lepto-cylindrus* | *Nitzschia* | *Pleurosigma* | *Schröderella* | *Thalassio-sira* |
|---|---|---|---|---|---|---|---|
| 1954 | Number of Cells/Litre | | | | | | |
| January | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| February | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| March | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| April | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| May | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| June | 0 | 10,000 | 0 | 30,000 | 0 | 80,000 | 175,000 |
| July | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| August | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| September | 75,000 | 487,500 | 35,000 | 27,500 | 2,500 | 0 | 105,000 |
| October | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| November | 0 | 570,000 | 0 | 5,000 | 0 | 0 | 32,500 |
| December | 0 | 3,657,500 | 0 | 5,000 | 7,500 | 0 | 5,000 |

TABLE 30.

PHYTOPLANKTON COUNTS, STATION DA (30 METRES).

| Phytoplankton Genera | *Chaetoceros* | *Nitzschia* | *Peridinium* | *Prorocentrum* | *Schröderella* | *Thalassiosira* |
|---|---|---|---|---|---|---|
| 1954 | Number of Cells/Litre | | | | | |
| January | 0 | 0 | 0 | 0 | 0 | 0 |
| February | 0 | 0 | 0 | 0 | 0 | 0 |
| March | 0 | 0 | 0 | 0 | 0 | 0 |
| April | 0 | 0 | 0 | 0 | 0 | 0 |
| May | 0 | 0 | 0 | 0 | 0 | 0 |
| June | 20,000 | 87,500 | 5,000 | 5,000 | 82,500 | 222,500 |
| July | 0 | 0 | 0 | 0 | 0 | 0 |
| August | 0 | 0 | 0 | 0 | 0 | 0 |
| September | 0 | 0 | 0 | 0 | 0 | 0 |
| October | 0 | 0 | 0 | 0 | 0 | 0 |
| November | 52,500 | 0 | 0 | 0 | 0 | 5,000 |
| December | 85,000 | 0 | 0 | 0 | 0 | 0 |

TABLE 31.

PHYTOPLANKTON COUNTS, STATION DA (50 METRES).

| Phytoplankton Genera | *Chaetoceros* | *Thalassiosira* |
|---|---|---|
| 1954 | Number of Cells/Litre | |
| January | 0 | 0 |
| February | 0 | 0 |
| March | 0 | 0 |
| April | 0 | 0 |
| May | 0 | 0 |
| June | 0 | 10,000 |
| July | 0 | 0 |
| August | 0 | 0 |
| September | 0 | 0 |
| October | 0 | 0 |
| November | 0 | 2,500 |
| December | 30,000 | 0 |

## Table 32.

### Phytoplankton Counts, Station DB (0 Metres).

| Phytoplankton Genera | *Asterionella* | *Ceratium* | *Chaetoceros* | *Chaetoceros socialis* | *Hemiaulus* | *Leptocylindrus* | *Licmophora* | *Nitzschia* | *Peridinium* | *Pleurosigma* | *Prorocentrum* | *Rhizosolenia* | *Skeletonema* | *Thalassiosira* | *Thalassionema* | *Stephanopyxis* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1954 | Number of cells/liter | | | | | | | | | | | | | | | |
| January | 0 | 5,000 | 415,000 | 60,000 | 0 | 0 | 2,500 | 650,000 | 5,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| February | 0 | 15,000 | 25,000 | 0 | 0 | 0 | 0 | 17,500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| March | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5,000 | 5,000 | 0 | 0 | 0 | 0 | 0 |
| April | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| May | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| June | 27,500 | 0 | 37,500 | 0 | 0 | 0 | 0 | 52,500 | 0 | 7,500 | 0 | 0 | 35,000 | 27,500 | 0 | 0 |
| July | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| August | 0 | 0 | 0 | 0 | 2,500 | 0 | 0 | 7,500 | 0 | 0 | 0 | 0 | 0 | 82,500 | 0 | 0 |
| September | 87,500 | 0 | 132,500 | 0 | 0 | 87,500 | 0 | 190,000 | 0 | 0 | 0 | 0 | 15,000 | 200,000 | 15,000 | 0 |
| October | 35,000 | 0 | 145,000 | 0 | 15,000 | 10,000 | 0 | 377,500 | 0 | 0 | 0 | 0 | 2,445,000 | 30,000 | 0 | 0 |
| November | 0 | 0 | 392,500 | 0 | 0 | 0 | 0 | 0 | 5,000 | 0 | 0 | 17,500 | 0 | 42,500 | 0 | 5,000 |
| December | 45,000 | 0 | 602,500 | 0 | 0 | 0 | 0 | 130,000 | 0 | 2,500 | 0 | 0 | 470,000 | 55,000 | 0 | 0 |

## Table 33.

### Phytoplankton Counts, Station DB (5 Metres).

| Phytoplankton Genera | *Asterionella* | *Ceratium* | *Chaetoceros* | *Chaetoceros socialis* | *Dinophysis* | *Hemiaulus* | *Leptocylindrus* | *Navicula* | *Nitzschia* | *Peridinium* | *Pleurosigma* | *Prorocentrum* | *Rhizosolenia* | *Skeletonema* | *Thalassionema* | *Thalassiosira* | *Stephanopyxis* | *Corethron* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1954 | Number of cells/litre | | | | | | | | | | | | | | | | | |
| January..... | 0 | 7,500 | 2,077,500 | 77,500 | 0 | 0 | 0 | 0 | 2,097,500 | 2,500 | 2,500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| February..... | 0 | 12,500 | 70,000 | 0 | 5,000 | 0 | 7,500 | 0 | 2,500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| March..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,500 | 0 | 0 | 0 | 0 | 0 | 0 |
| April..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| May..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| June..... | 12,500 | 0 | 40,000 | 0 | 0 | 0 | 0 | 0 | 2,500 | 0 | 0 | 0 | 0 | 0 | 0 | 50,000 | 0 | 0 |
| July..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| August..... | 0 | 0 | 82,500 | 0 | 0 | 5,000 | 0 | 0 | 15,000 | 0 | 0 | 0 | 0 | 0 | 0 | 95,000 | 0 | 0 |
| September..... | 127,500 | 0 | 372,500 | 0 | 0 | 37,500 | 137,500 | 0 | 215,000 | 0 | 0 | 0 | 0 | 0 | 15,000 | 435,000 | 0 | 0 |
| October..... | 5,000 | 0 | 55,000 | 0 | 0 | 0 | 0 | 0 | 175,000 | 0 | 0 | 0 | 0 | 540,000 | 2,500 | 40,000 | 0 | 0 |
| November..... | 0 | 0 | 1,015,000 | 0 | 0 | 0 | 0 | 2,500 | 0 | 0 | 0 | 2,500 | 10,000 | 0 | 0 | 100,000 | 10,000 | 5,000 |
| December..... | 22,500 | 0 | 1,097,500 | 0 | 0 | 0 | 0 | 0 | 85,000 | 0 | 0 | 0 | 0 | 155,000 | 0 | 35,000 | 0 | 0 |



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## Table 34.

### Phytoplankton Counts, Station DB (10 Metres).

| Phytoplankton Genera | *Asterionella* | *Ceratium* | *Chaetoceros* | *Chaetoceros socialis* | *Dinophysis* | *Hemiaulus* | *Leptocylindrus* | *Nitzschia* | *Peridinium* | *Pleurosigma* | *Prorocentrum* | *Skeletonema* | *Stephanopyxis* | *Thalassionema* | *Thalassiosira* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1954 | Number of cells/litre | | | | | | | | | | | | | | |
| January | 0 | 15,000 | 625,000 | 152,500 | 2,500 | 0 | 0 | 1,067,500 | 5,000 | 5,000 | 0 | 0 | 0 | 0 | 0 |
| February | 0 | 22,500 | 20,000 | 0 | 0 | 0 | 0 | 2,500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| March | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5,000 | 0 | 0 | 0 | 0 |
| April | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| May | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| June | 10,000 | 0 | 12,500 | 0 | 0 | 0 | 0 | 7,500 | 0 | 0 | 0 | 0 | 0 | 0 | 22,500 |
| July | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| August | 0 | 0 | 15,000 | 0 | 0 | 7,500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 80,000 |
| September | 312,500 | 0 | 365,500 | 0 | 0 | 7,500 | 87,500 | 137,500 | 0 | 0 | 0 | 0 | 10,000 | 5,000 | 327,500 |
| October | 0 | 0 | 450,000 | 0 | 0 | 0 | 7,500 | 205,000 | 2,500 | 5,000 | 0 | 987,500 | 0 | 5,000 | 10,000 |
| November | 0 | 0 | 427,500 | 0 | 0 | 0 | 0 | 20,000 | 0 | 0 | 0 | 0 | 0 | 0 | 52,500 |
| December | 0 | 0 | 1,220,000 | 0 | 0 | 0 | 0 | 20,000 | 0 | 2,500 | 0 | 67,500 | 0 | 0 | 20,000 |

## Table 35.

### Phytoplankton Counts, Station DB (20 Metres).

| Phytoplankton Genera | *Asterionella* | *Ceratium* | *Chaetoceros* | *Chaetoceros socialis* | *Dinophysis* | *Hemiaulus* | *Leptocylindrus* | *Nitzschia* | *Peridinium* | *Pleurosigma* | *Rhizosolenia* | *Skeletonema* | *Thalassiosira* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1954 | Number of cells/litre | | | | | | | | | | | | |
| January | 0 | 22,500 | 170,000 | 27,500 | 7,500 | 0 | 0 | 615,000 | 0 | 15,000 | 0 | 0 | 0 |
| February | 0 | 22,500 | 15,000 | 0 | 30,000 | 0 | 0 | 0 | 2,500 | 0 | 0 | 0 | 0 |
| March | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| April | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| May | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| June | 0 | 0 | 20,000 | 0 | 0 | 0 | 0 | 12,500 | 0 | 7,500 | 0 | 22,500 | 20,000 |
| July | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| August | 15,000 | 0 | 7,500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 85,000 |
| September | 62,500 | 0 | 255,000 | 0 | 0 | 5,000 | 67,500 | 90,000 | 0 | 0 | 2,500 | 0 | 202,500 |
| October | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| November | 0 | 0 | 82,500 | 0 | 0 | 0 | 0 | 0 | 0 | 2,500 | 0 | 0 | 35,000 |
| December | 0 | 0 | 245,000 | 0 | 0 | 0 | 0 | 2,500 | 0 | 0 | 0 | 7,500 | 5,000 |



Reprint from "Commerce & Industry", April, 1957

TABLE 36.

PHYTOPLANKTON COUNTS, STATION DB (30 METRES).

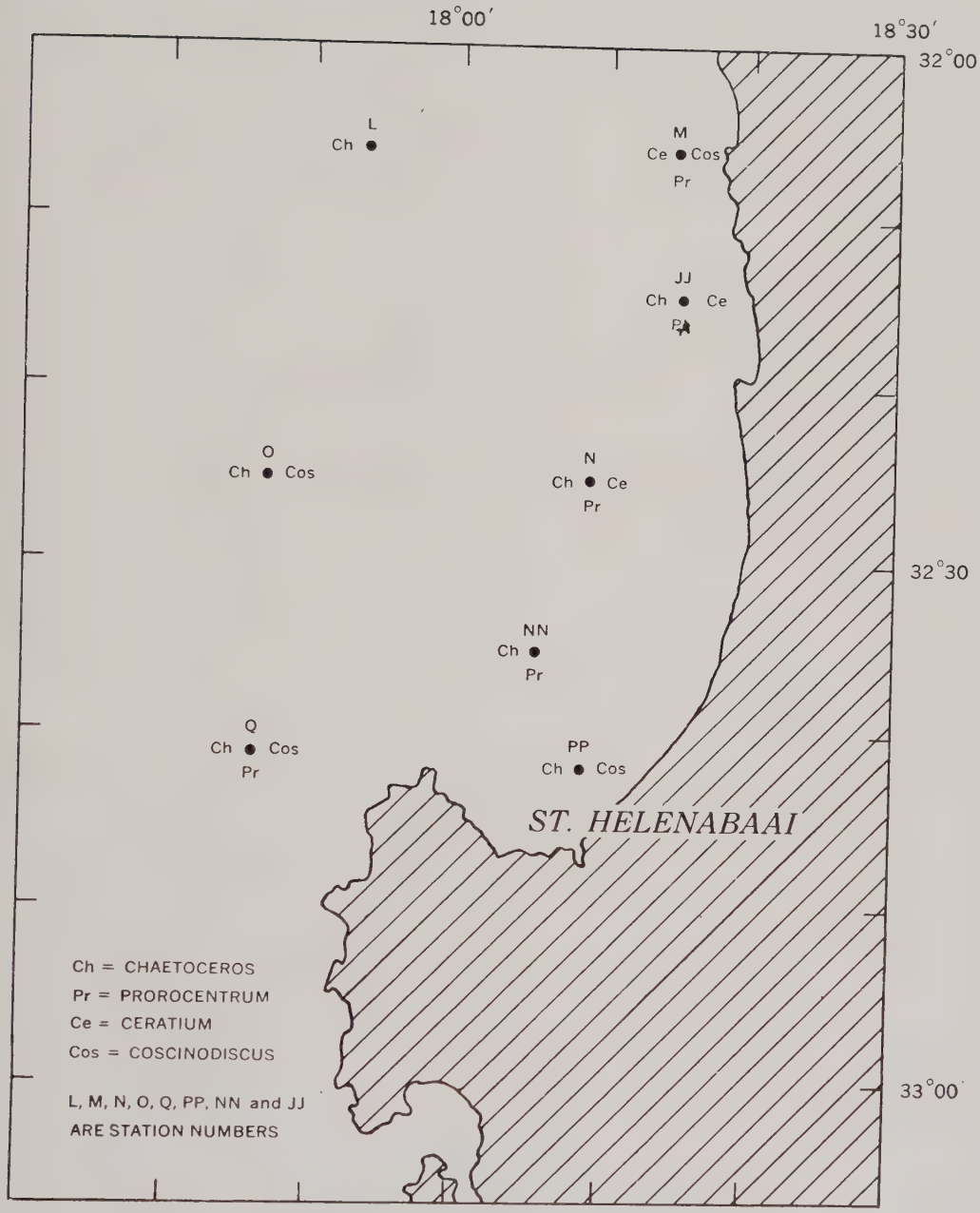
| Phytoplankton Genera | *Asterionella* | *Chaetoceros* | *Corethron* | *Nitzschia* | *Peridinium* | *Pleurosigma* | *Thalassio-sira* |
|---|---|---|---|---|---|---|---|
| 1954 | Number of Cells/Litre | | | | | | |
| January | 0 | 147,500 | 0 | 85,000 | 2,500 | 2,500 | 0 |
| February | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| March | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| April | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| May | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| June | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| July | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| August | 0 | 7,500 | 2,500 | 5,000 | 0 | 0 | 27,500 |
| September | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| October | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| November | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| December | 5,000 | 130,000 | 0 | 2,500 | 0 | 0 | 0 |

TABLE 37.

PHYTOPLANKTON COUNTS, STATION DB (50 METRES).

| Phytoplankton Genera | *Chaetoceros* | *Nitzschia* | *Thalassiosira* | *Skeletonema* |
|---|---|---|---|---|
| 1954 | Number of Cells/Litre | | | |
| January | 0 | 0 | 0 | 0 |
| February | 0 | 0 | 0 | 0 |
| March | 0 | 0 | 0 | 0 |
| April | 0 | 0 | 0 | 0 |
| May | 0 | 0 | 0 | 0 |
| June | 0 | 0 | 0 | 0 |
| July | 0 | 0 | 0 | 0 |
| August | 15,000 | 0 | 7,500 | 0 |
| September | 0 | 0 | 0 | 0 |
| October | 0 | 0 | 0 | 0 |
| November | 25,000 | 0 | 0 | 0 |
| December | 487,500 | 2,500 | 0 | 7,500 |

PLATE 1




DISTRIBUTION OF PHYTOPLANKTON GENERA
WHICH WERE ABUNDANT, AUTUMN, 1954. (N50V)

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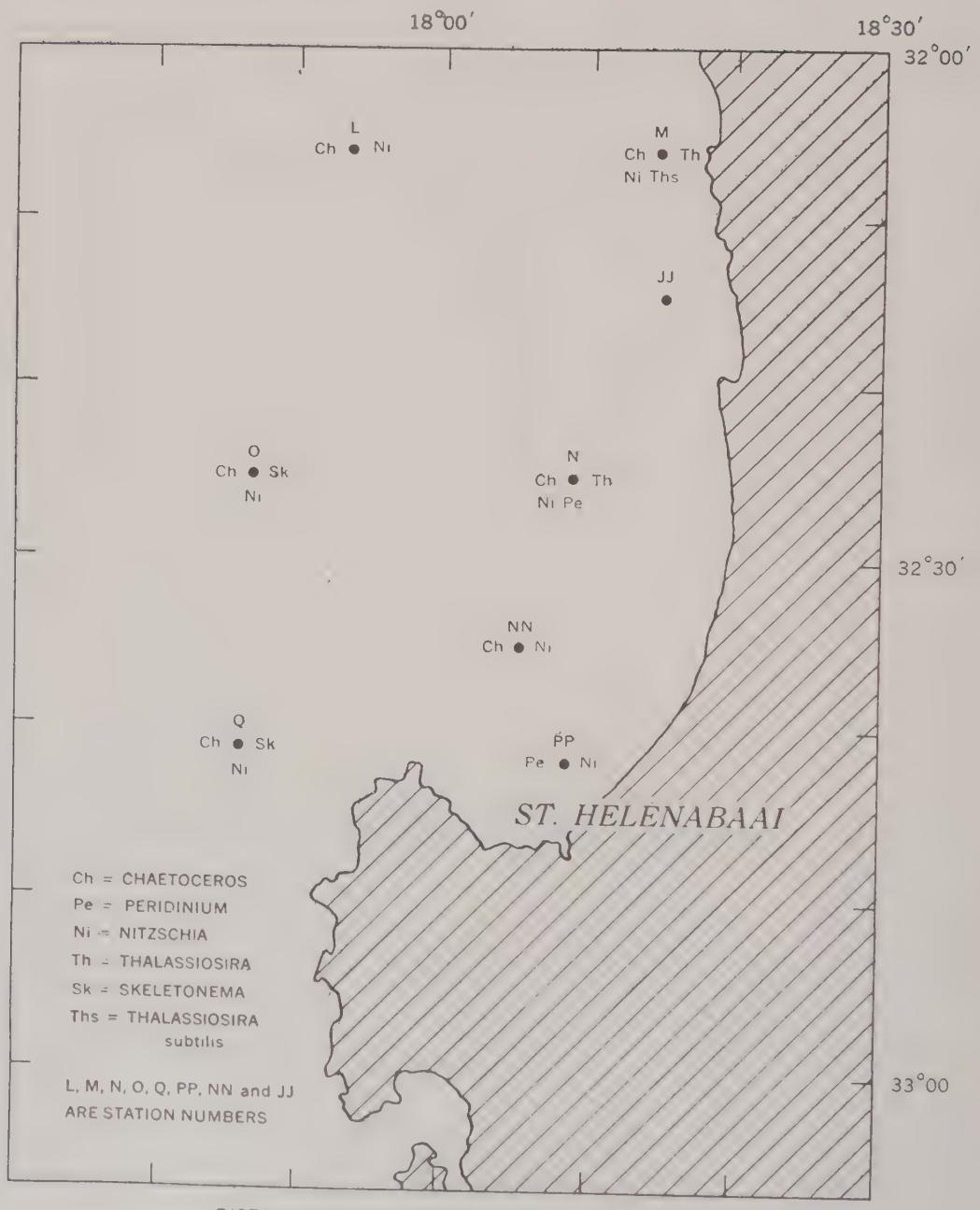
PLATE 2




DISTRIBUTION OF PHYTOPLANKTON GENERA
WHICH WERE ABUNDANT, WINTER, 1954. (N50V)

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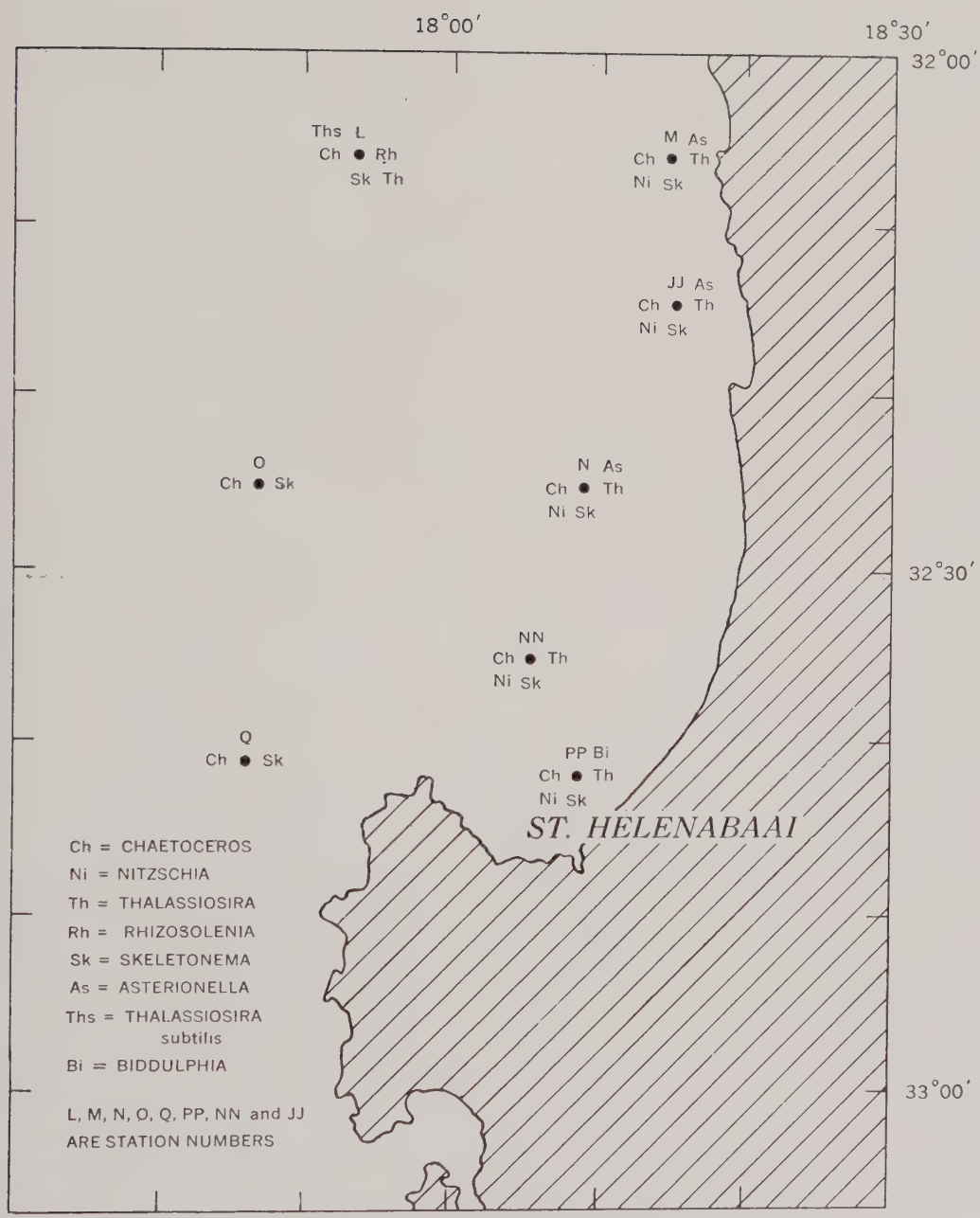
PLATE 3




DISTRIBUTION OF PHYTOPLANKTON GENERA
WHICH WERE ABUNDANT, SPRING, 1954. (N50V)

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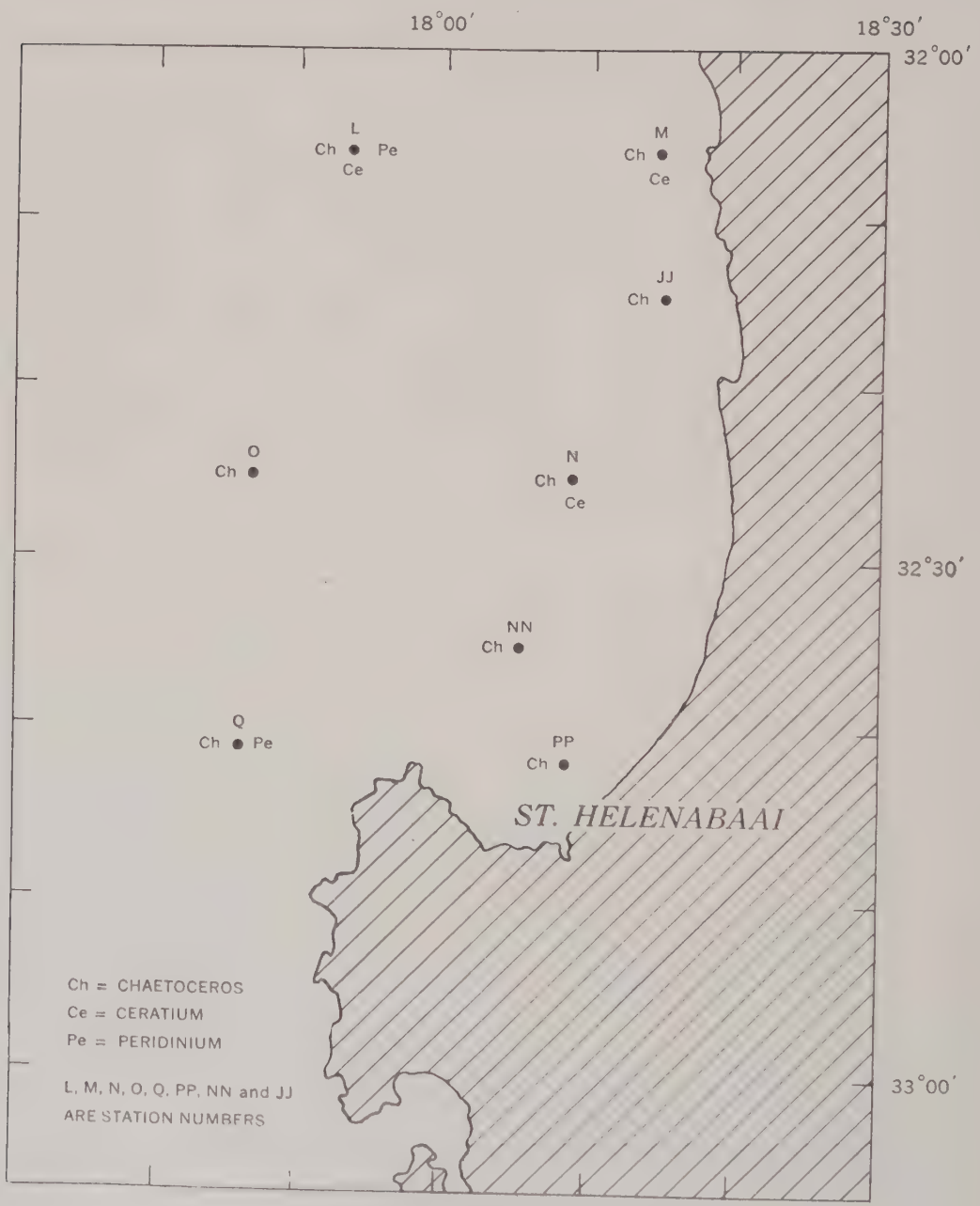
Government Printer, 1956

PLATE 4




DISTRIBUTION OF PHYTOPLANKTON GENERA
WHICH WERE ABUNDANT, SUMMER, 1954. (N50V)

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